Canada. Commission of Inquiry
on the Pharmaceutical Industry
Market structure and performance
in the pharmaceutical industry
(background study)

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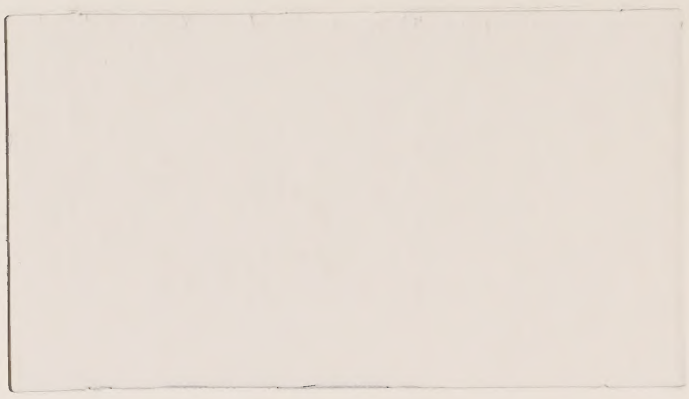
Canada



Market Structure and Performance in the Pharmaceutical Industry

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1. Introduction

The goal of this report is twofold, first to specify an equilibrium model that captures the empirical realities of the pharmaceutical industry, and second, to evaluate alternative informational policies to guarantee an efficient market for pharmaceutical products. This requires not only an integration of the extant economics literature on this industry but some independent analysis of the critical features of the industry. The dominant firms in the provision of potential or branded pharmaceuticals in this industry are vertically integrated multinationals. Ultimately any model of the industry should provide a vehicle for assessing the current regulatory policies imposed on the pharmaceutical industry in Canada. These policies vary somewhat across provinces but the federally imposed policies on the production of generic substitutes are unique to Canada. The Canadian institutional features are described in Gorecki (1981).

Leaving aside the rules imposed by governments on generic substitutability, there are several features of the international pharmaceutical industry (presented in Egan et al (1982), Gorecki (1981), Leffler (1981) and Temin (1979)) common across countries. (Generics may alter somewhat certain margins but these common industry features still prevail.) These include:

(1) large promotional expenditures by branded pharmaceutical firms

(2) "limited" price competition

(3) high accounting rates of return (a high ratio of accounting profits to book value of equity) for branded pharmaceutical firms

(4) division of markets between institutional demanders (hospitals and some provincial governments) and individual consumers (patients); lower prices and less promotional efforts to institutional demanders.

(5) health insurance plans (sometimes publicity provided) which may cover some proportion of drug costs.

(6) branded pharmaceutical firms that are both multinational and vertically integrated (into research, production, and marketing).

Temin (1979) traces the historical evolution of the industry in the U.S. Prior to 1938 in the U.S., no drug prescriptions were required by patients but there was an very limited supply of drugs as the technology for producing drugs was extremely limited and fixed. In 1938, the U.S. Federal Food, Drug and Cosmetic Act was passed requiring prescriptions from physicians for certain drugs. At the same time, scientific advances meant the production of new drugs that were deemed to be patentable.

According to Temin, these changes signified a change in the customers of drug firms from individual consumers (patients) to physicians. The significant feature of this arrangement was that doctors did not themselves pay for the drugs which they prescribe. At the same time, the informational content of labelling was altered. Over-the-counter labels continued to have substantial information; prescription drug labels had limited information and information on drugs was passed directly from the vertically integrated drug firms to the physicians. The charge is that patenting plus doctor prescriptions led to high prices.

Firms doing the research have a choice after inventing: They can either produce and market exclusively themselves or contract out through licensing arrangements the production and distribution of the product.

For whatever reasons, pharmaceutical manufacturers choose the former. With the targeted agency group as physicians, at least for individual patients, the distribution mechanism focused its advertising efforts at the doctors. Relative to generic firms where substitutes are available, advertising by the branded firms would be higher as these firms capture fully the quasi-rents from the advertising investment (i.e., there are no advertising spillovers).

Temin's description of the equilibrium features of the pharmaceutical industry are consistent with other writers; further, his historical placement of the facts as a consequence of the 1938 Act together with the decision to allow patenting of the branded formulae aid in understanding the current features of the industry. In this report, we proceed further still to develop a simple theoretical model that identifies precisely the source of these key industry features. There is one important aspect of the regulation in this industry that we will not discuss. If the equilibrium characteristics of the pharmaceutical industry are an inevitable consequence of (i) the passage of the 1938 Act and (ii) the decision to permit product patenting, we will not analyze the political economy of these decisions. Why were these decisions made at this time by public authorities? Therefore we consign to outstanding issues the economic analysis of the imposition of prescription requirements on the profits of pharmaceutical firms, physicians and retail pharmacists. Nevertheless it is our belief that an understanding of these issues would add considerably to our knowledge of the economics of this industry.

To understand better the significance of each of the stylized equilibrium features, we proceed to develop a sequence of simple models of consumer and firm/physician decisions concerning treatment, the retail pharmacy market and the incentives facing drug manufacturers. Before turning our attention to this task, the next Section presents a critical survey of relevant literature on the economics of this industry.

2. The Efficiency of Product Promotion in Pharmaceutical Markets: A Critical Review of the Literature

The expenditure on the promotion of drug products is among the most intensive of any market. Estimates of the expenditure on promotion, including advertising and promotion by detail men, as a proportion of total sales revenue are as high as 45 per cent in the U.S. market (Egan, Higanbotham and Weston (1982): 6). A study by Comanor and Wilson (1974) placed the industry third, behind perfume and cereals, in promotional intensity. While the precise estimate of advertising intensity for pharmaceuticals is a matter of some disagreement (see below), there is a consensus that it is relatively high.

Does the intense promotion of products in this industry represent a pro-competitive and efficient aspect of the market organization or an anti-competitive effect? The views that have been expressed on this question fall between two extremes, which we label the "pro-competitive view" of advertising as information and the "anticompetitive view" of product promotion as an efficient barrier to entry in the pharmaceutical industry. These views are paraphrased and critically discussed below.

2.1 Product Promotion is Anti-Competitive

> "Expenditure on promotion of drugs by pharmaceutical manufacturers is not only wasteful, but socially damaging. Advertising serves to differentiate, in the minds of consumers, drugs that are virtually identical. The manufacturer of the branded drug exploits the artificial, perceived advantage of branded drugs over generics by extracting monopoly profits through a high price. The main effect of advertising is thus to create a barrier to entry, leading to greater concentration, greater deviation of prices from marginal costs (i.e., a less efficient allocation of resources) and greater profits."

This view has as its historical basis the economic writings of Joe Bain (1956), more recently William Comanor and Tom Wilson (1974) and, in general, the "Harvard School of Industrial Organization". Bain argued that product differentiation is achieved partly through promotional efforts designed to win the loyalty of potential customers. Once this loyalty is achieved, any potential entrant into the industry is at a disadvantage compared to the firm with an established market; the entrant would itself have to advertise intensively or price very low to break into the market. That is, by advertising a firm creates a barrier to entry. This protection against entry allows the firm to price above production costs, earning monopoly rents.

Comanor and Wilson (1974) give the definitive statement of the position that advertising leads to economic profits through the creation of barriers to entry. These authors found that advertising consistently "explained" the cross-industry variation in profit rates in the United States economy (using data from the mid-1950's). The intensity of advertising was in fact the only consistently significant independent variable in their profit regressions. Comanor and Wilson (1967: 437) conclude that advertising generates substantial profits and these are accounted for by the barrier to entry created through advertising. The Comanor and Wilson findings have been referred to as a "consensus" in a recent textbook of industrial organization (Shephard 1979: 374).

The second element of the anticompetitive view - that advertising is largely persuasive rather than informational - is more a value judgment than an empirically testable proposition. If promotional expenditures shift a demand curve upwards, then advertising must be judged as informational if the new demand is taken as revealing consumers welfare, i.e., if the assumption of consumer sovereignty is maintained. If the shift in demand is judged to be due to persuasion, rather than a revelation of information, then the assumption of consumer sovereignty

is being abandoned. The point is that the issue of the informational content of advertising is not something that can be determined by the examination of specific advertising messages; it is an issue that is decided by a value judgement. Nonetheless, economists have attempted to put estimates on the proportions of advertising messages that are "informative" and "persuasive". According to Scherer (Scherer 1970: 324-32), the rough consensus that emerged from the literature to 1970 was that the mix was half-and-half. This could not, however, be described as a consensus from more recent literature.

Against this intellectual background, a literature critical of the pharmaceutical industry developed in the U.S. following the hearings of the Kefauver Senate Subcommittee between 1959 and 1961. Leffler (1981: 51) reports that the allegations included the charge that drug promotions to physicians were "misleading, uninformative and responsible for high drug prices". Two papers by Henry Steele (1962 and 1964) led the criticism. These papers (according to Egan, Higginbotham and Weston (1982: 60)) "remain the definite attack on the drug industry". Steele argued that a number of characteristics of the industry mark the unregulated market outcome inefficient.

A feature of the demand side of the market for drugs, Steele argued, makes it prone to the exploitation of market power by large firms. This feature is that doctors are the individuals who make the choice of which drug to buy, whereas it is consumers (or a medicare plan) who end up paying for the drug. Because they do not capture directly the benefits of a lower price, doctors have little or no incentive to switch from recommendations of the high-priced branded drug when low-priced generics became available. This feature of the ethical drug market is cited frequently as a reason why apparent - but unreal - differences in brands can persist, leading to inelastic demand for established brands of drugs.

In fact, this feature of the market for drugs is not per se a problematic or even distinguishing aspect of the market. Patients buy from doctors a health care package or disease treatment package. A doctor products this package using a variety of inputs, including drugs (or drug prescriptions). The doctor chooses the mix of inputs into the health care package, just as the manufacturer of any product sold in the retail market chooses inputs in production. By way of analogy, an automobile manufacturer does not leave the selection of car parts up to the car buyer even though the buyer, like a consumer of medical services, is the one who ultimately pays for the parts. The demand for a drug product is a derived demand - the demand for an input into the health care package - but this in itself does not make it inelastic.

The inelastic nature of the demand for drugs is the consequences of two other features of market transactions. First, the demand for individual doctors' services is price-inelastic (even ignoring the effects of social health insurance). This is because relatively little search on the basis of price takes place in the market for these services. Prices are not often posted or agreed upon before a doctor and a prospective patient establish a relationship and in any case, doctors services or disease treatments are multi-dimensional making price comparison difficult. Therefore, the demand for drugs is price-inelastic as the derived demand from a final demand (that for health care or specific disease treatment) that is price-inelastic.

The second feature leading to inelastic demand for drugs is that to the extent that the cost of drugs is subsidized by a government medicare programme, the doctor has little incentive to search for a low-priced good. The investment in search for a low-priced input into the treatment package offered has little effect on consumer's demand for the doctor's services (irrespective of the informational problems in the market mentioned above) if the consumer is

not bearing the cost of the input. This failure by the doctor to invest in knowledge of the availability of low-priced drugs is a moral hazard problem associated with health insurance. Just as the doctor has the incentive to provide excessive amounts of care under health insurance, he or she has an inadequate incentive to minimize the cost of providing a given amount of care if investment in information is an input paid for by the doctor.

In sum, the demand for a particular brand of a drug may be very price-inelastic, but this is not - as is commonly argued - because the doctor rather than the patient chooses the drug. The lack of price responsiveness of the derived demand is due to the lack of price search in the market for doctor's services and to a moral hazard problem associated with health insurance.

Steele and other critics of the international pharmaceutical industry argue that advertising and the creation of brand names in the industry are wasteful or even socially damaging. The intellectual basis for this position is Bain's theory of product differentiation as a source of barriers to entry. The critics of the pharmaceutical industry argue that advertising creates monopoly power through artificial product differentiation, leading to excessive prices for brand name products that are in fact not superior to low-cost generic substitutes, and to high profit rates in the industry.

Indeed, the market for ethical drugs is perhaps the clearest example of what some economists would refer to as a market with "artificial" product differentiation. For each of many branded drugs there are a number of generic drug compounds, identical in the essential chemicals and perfect substitutes in terms of medical effectiveness. But the investment in promotion (and early entry into the market) by the typical branded drug yields a greater demand

for the branded drug, at a given price, than for any generic drug product. The greater demand for the dominant but essentially identical product would be taken by many economists to signal artificial product differentiation, an unjustified preference for the dominant brand. The critical feature of drug products that leads to this conclusion is that they can - to a greater extent than almost any other product - be grouped into classes of objectively identical (medically equivalent) products.

This observation alone does not yield the conclusion that product differentiation even if it is merely "perceived", among medically equivalent products is necessarily against the public interest. This is the conclusion that would be reached with a purely static view of the industry, but many issues in the industry must be analyzed with a dynamic model. The possible inefficiency of "artificial" product differentiation must be analyzed within the typical pattern of entry into a new drug class and the subsequent life-cycle of the market for a particular drug. The new drug is introduced typically by a single firm which builds a brand-name for the specific drug brand and, in addition, informs doctors and pharmacists of the existence of the new drug, the return for both discovering the drug and for disseminating to doctors the information about the drug accrue to the first entrant in two forms: The quasi-rents earned during the period when this firm may be in a monopoly position in the market, and the quasi-rents earned on the brandname advantage that the firm retains when the market is entered by other firms (typically generics). A reduction in the brand name advantage would be efficient in a static sense, but its cost in terms of reductions in the incentive to innovate and in the incentive to disseminate information about new drugs must be recognized.

Two pieces of evidence are alleged to support the anticompetitive view of promotion specific to this industry: evidence of very high promotion expenditures to sales ratios in the U.S. drug industry relative to other markets, and evidence of very high accounting rates of return in branded drug manufacturing. More generally, advertising-accounting profit or rate of return correlations (of the Comanor-Wilson type) are used to justify the view of advertising as a barrier to entry. There is considerable disagreement on the level of promotional expenditures in the U.S. industry. Scherer (1970: 329) reports without documentation a promotion to sales ratios of 29 per cent. The Kefaurer hearings estimated incorrectly a ratio of 25 per cent (Leffler 1981: fn. 30). Egan, Higanbotham and Weston (1982: 6) report that promotion and marking activities constitute 45 per cent of sales. But Leffler reports ratios averaging about 11 per cent during the 1970's. Even this figure places prescription drugs as one of the more heavily promoted products.

It is important that the statistical discrepancy in these figures be resolved. For a promotion to sales ratio of ten to twelve per cent, if this is the correct figure, has an important policy implication. This figure means that if advertising were cut in half via public policy and if all of the reduced costs were passed on to consumers then the resulting decrease in price would be of the order of only five per cent. In addition, this figure would represent a welfare increase of the same dollar amount only under the extreme assumption that the positive informational role of advertising were zero. The implication is that if prices are to be reduced in this industry through policy that brings about a reduction in promotion of drug brands, any substantial reduction must come from a source other than the savings in "wasteful" promotional expenditures.

If the extreme assumption of a zero-information value of advertising is relaxed, then this implication follows a fortiori. The possibility of large welfare gains in this market through reduction in promotional expenditures by pharmaceutical manufacturers may be much less significant than the "anticompetitive" school has claimed. The ratio of promotional expenses to sales revenue in this industry does not, in itself, indicate this possibility.

The other evidence used to justify the anticompetitive view of advertising and promotion in pharmaceuticals is the estimation of high accounting rates of return. Accounting rates of return (income to book equity ratios), however, are not reliable proxies for economic rates of return on capital, which are the appropriate measure of industry rents. (This is now well-known.)

Although there are many sources of bias in accounting rates of return, the main source is that certain expenditures that should be treated as investments in capital stocks, are not. Most importantly, the expenditures on advertising represent investment in the stock of goodwill, loyalty or the brand name of a firm and expenditures on research and development represent investment in the stock of knowledge which is a factor of production. When these expenditures are deducted as current expenses on a particular income statement then the level of firm earnings is understated; the omission of the stocks of the brand name and knowledge from the base on which the rates of return are calculated means that the base is also understated. The two types of bias introduced are offsetting in the calculation of the ratio of earnings to capital stock.

The net result of the bias depends upon a number of factors, especially the nominal growth of the company (due to inflation for example). In a steady state with zero growth, for example, it is clear that the biases cancel and

the accounting and economic rates of return coincide. The prediction of the net bias in a market with positive growth or inflation is analyzed in Fisher and McGowan (1983). For our context, the pharmaceutical industry, the important proposition is that the accounting rate of return will overstate the economic rate of return when growth is positive. The overstatement can be severe - by as much as seventy per cent for "reasonable" parameter values (Fisher and McGowan (1983: 87-8)). This bias is most severe in markets with high advertising intensity and high R and D intensity because the failure of accounting rates of return to treat these expenditures as investments in capital stocks is the source of bias. The pharmaceutical industry is the canonical example of such a market.

For predicting whether excessive profits are being earned in the world drug market, examination of the structure of the market is more useful than accounting data. There are 32 major drug companies in the world as well as a number of small companies. While all of these companies do not produce in each therapeutic class or submarket, entry into any class is relatively easy for many of the companies. The cost of entry into a particular submarket, i.e., the expenses that must be sunk in order to put an entrant on equal ground with an established firm, are the investment in knowledge of the production (and R&D) processes and in establishing a brand name for the specific product. A flow of revenue for established firms, above variable costs, rather than indicating excessive profits, must - in many cases - represent a return on the investment in these market-specific assets in most therapeutic classes.

Additional evidence cited in general in favour of the "advertising-as-a-barrier" hypothesis are high correlations between advertising and both concentration and profit. The advertising-concentration correlation supposedly indicates that barriers to entry are successfully established with advertising,

and the advertising-point correlation is taken to imply that the barrier to entry allows exploitation of market power via monopoly pricing.

The evidence on high profit rates in the industry is questionable, as we have discussed above. The general empirical facts of the industry - dominance of the first entrant (discoverer) into a new market, fairly high concentration but relatively rapid turnover of leading positions in the market, high mark-ups of price over average variable costs, and intensive promotion - can be explained without reference to the theory that advertising serves mainly as a barrier to entry, protecting dominant firms against potential competition.

We offer an explanation that combines the hypothesis of advertising as information with the model of Schumpeterian competition. In each therapeutic class, firms engage in research, some of which may be to duplicate an existing product, but some of which is to discover fundamentally new treatment. Upon discovering a new product, the firm must advertise intensively to inform doctors of its new drug. During the first few years after discovery, the firm enjoys a dominant position in the market during which it earns quasi-rents. Its price exceeds marginal cost significantly, adding to the incentive to advertise intensively during this period. After several years, substitute products (possibly "me-too" drugs) are developed. During the "second stage" of the products life-cycle, the existence of close substitutes limits the market power of the dominant product. Some advantage to being established does accrue to this product however as many of the doctors selecting from the therapeutic class will not undertake the investment in time to ascertain that the new substitutes are of equal quality, choosing instead to stick with the known brand. Thus the price of the branded drug is lower than in the first stage, but greater than the prices of the generic drugs. On average, the

rents earned by the discoverer of the new product over both stages of the product life-cycle just compensate for the investment in research.

So far this hypothesis does not contradict the advertising-as-an-entry-barrier hypothesis; the latter could simply be expressed as the hypothesis that the second-stage is very long or indefinite and that the maintained advantage of entering first is substantial. "Active" Schumpeterian competition, however, implies that the dominant product is replaced frequently (the more active the competition, the more frequent the replacement). In addition, the second half of the hypothesis - that advertising is informative - implies that advertising is more intensive for newer products, rather than a means of protecting the dominant position of established products.

Two kinds of evidence, therefore, distinguish the pro-competitive and anti-competitive theories of advertising in the drug industry. First, an index of market share stability and general evidence on the rate of turnover of leading market positions in each therapeutic class can identify Schumpeterian competition - as a matter of degree - from the entry barrier hypothesis. For example, an index of turnover could be used to determine how the persistence of dominant positions in the markets for various drugs compares with that in other industries. Second, data on promotion/sales ratios could be used to determine whether advertising is greater for newer products, as the second hypothesis implies. In addition, as Leffler (1981) points out, the advertising as information hypothesis offers a testable implication regarding the mix of promotional expenditures as between detail men and advertising in medical journals: Early in a product's life cycle relatively more promotion should take place through detail men since this type of promotion is more effective in informing of the existence of a new product.

2.2 Product Promotion is Pro-competitive

> "Advertising serves to inform doctors and pharmacists about the existence and qualities of new drugs, and to improve doctors' search for effective treatment by reminding them of the existence of established drugs. Advertising will be undertaken by manufacturers only to the extent that it is "demanded" by the market as a means of reducing uncertainty about the quality and availability of drugs, uncertainty that comprises part of the cost of purchasing or recommending a drug."

This view of advertising, which comes from the "Chicago School of Economics" is diametrically opposed to the first hypothesis. In a market like the pharmaceutical industry where products change frequently, where there are thousands of different products and where the choice of the correct product is often critical, information about products is vital to consumers. Doctors reveal that promotion by detail men has informative value by investing their own time in listening to detail men. A 1958 AMA study cited by Leffler (1981: fn. 45) that surveyed doctors found that the majority considered detail men the most useful source of information on new drugs.

Advertising and promotion of new drugs, where this hypothesis would predict that these expenditures are most intensive, serves to inform doctors of the existence of the drugs. Advertising of established drugs - e.g., advertisements in medical journals directed towards doctors - may not appear to have any informative vale. But by simply reminding the doctors of established products' availability, the argument goes, these advertisements lower doctors' costs of recall, part of the costs of search.

The pro-competitive view of the informative content of advertising in the pharmaceutical industry is contrasted with the alternative view by Leffler (1981: 46)

> "The polar positions on the desirability of advertising are well represented in policy discussions of the prescription drug market. The continual introduction of new, potentially life-saving products makes the potential gains from the rapid dissemination of product information via advertising substantial. Nonetheless, government investigations of the pharmaceutical industry stress that intensive advertising of drugs results in excessive use of high-priced, heavily promoted brand-name products even though equivalent low-priced products are available. Those viewing pharmaceutical advertising with disfavour insist that these ads are frequently uninformative and seem simply to have the products names in order to persuade doctors to select products out of habit rather than by evaluative choice."

The most important empirical papers investigating or defending the pro-competitive view of advertising in the prescription drug industry are Telser et al (1975) and Leffler (1981). In a comprehensive analysis of industry data, Telser discovers a number of empirical relationships among entry rates, promotion expenditures and concentration across therapeutic drug classes, which are at odds with the barrier-to-entry hypothesis and which support the pro-competitive view. Among these are the following:

(1) An approximately zero correlation exists between concentration in the market on a particular date and subsequent entry.

Under the barriers to entry hypothesis, advertising and promotion allow high concentration in therapeutic classes by blocking entry into the classes. Thus we expect a negative correlation between concentration and subsequent entry, if the concentration is due to promotion acting as an entry barrier. Telser examined the correlation across therapeutic classes between concentration in 1963 and entry during the 1963-72 period, as measured by the proportion of the 1972 market held by firms entering after 1963.

Where a negative correlation would have supported the barrier to entry hypothesis, a positive correlation would be consistent with the Schumpeterian model of market life-cycle discussed above. The correlation estimated by Telser et al was close to zero.

Additional findings of Telser et al included the following:

(2) Controlling for the number of firms, there is more entry where existing firms are of larger size.

(3) Holding market size constant, there is more entry in markets with a smaller number of firms initially.

(4) Entry rises with promotional intensity.

(5) High concentration is less likely to persist in the drugstore market for prescription drugs, which is relatively advertising-intensive, than in the hospital market.

(6) Prices tend to fall in response to entry.

A number of econometric problems plague the interpretation of the results of Telser's single equation regressions. For example, in (4) the positive correlation between entry and promotional intensity may arise from the need for promotion in markets with many new entrants to make buyers aware of the products; this is consistent with the hypothesis of advertising as information, but reverses the causation. (Telser's data did not separate promotional expenditures by entrants from those by existing firms.) In general, however, Telser's empirical results support the pro-competitive view of advertising.

Leffler (1981) examines two questions.

(1) Is the intensity of branded advertising across therapeutic classes explained completely by the introduction of new products? How much

advertising is repeat-buy advertising?

The latter kind of advertising refers to advertising of established drugs which does not, on the surface, provide information. Leffler points out, however, that by reminding doctors of the existence of a brand, these advertisements do lower the cost of recall, and therefore of overall search, by doctors.

(2) If the variation in advertising/sales ratios across submarkets is not accounted for completely by the variation in the extent of new products, is it higher for riskier drugs or greater for continual use, repetitive treatment drugs?

The hypothesis of "advertising-as-information" would be supported if riskier, simple-use drugs were advertised more intensively; it is these drugs for which the value of information is greatest and for which information can be gathered easily through experience.

In particular, Leffler estimates a regression for advertising to sales ratios across therapeutic categories in 1978. Explanatory variables are (1) the number of new products between 1975 and 1978 and a set of dummy variables (2) equal to one if product represents an "important advance" (3) equal to one if the new entrant provides improved therapy (4) equal to one when the therapeutic categories are dominated by maintenance drug use (5) equal to one for categories with high risk from unsuccessful drug therapy. The results indicate that variables (1), (2) and (3) are positive and significant; this supports the pro-competitive informational hypothesis. Negative and significant coefficients on variables (4) and (5), however, support the anti-competitive repetitive advertising hypothesis. Leffler further found that detail expenditures on drugs are strongly directed at

doctors more likely to be familiar with and to use the drug. The conclusion is that advertising has both informative and persuasive features.

Does advertising by drug firms assist or inhibit entry? Leffler runs a regression to explain the market share of drugs one year after their introduction and several years later by, among other variables, the average promotional expenditures of competitors one year before entry. A positive coefficient for this variable is consistent with the hypothesis that advertising by competitors opens up markets for entrants; as such, this advertising assists entry.

The basic problem with the pro-competitive defense of market efficiency - indeed, the problem with the entire debate about advertising as efficient or not - is that the set of feasible policies against which the free market is being compared is never delineated precisely. To be of policy interest, a question about efficiency, must compare at least two feasible policies or allocations. The literature giving empirical evidence on the "procompetitive nature" of advertising implicitly argues simply that legal limits on advertising would not be welfare-improving.

But the interesting policy issues are not whether this particular regulation would improve performance. The specific policies are concerned with the replacement of market provision of information by public provision, as well as the reshaping of incentives of agents in the market (e.g., to substitute to lower priced goods). The next section sketches a model of the industry with particular attention to the equilibrium features of the market. Only by identifying appropriate margins can we hope to specify appropriate informational policies for this industry.

3. The Demand and Supply of Pharmaceuticals

We may identify four sets of economic agents who act in the market for pharmaceuticals: (i) consumers or patients (ii) physicians who prescribe drugs (iii) retail pharmacies who sell products at the retail level (iv) branded or generic manufacturers who develop and produce the drugs. The market is further altered by the presence of private and public health insurance to cover the costs to the patient of the physician and possibly the drug package. Restrictions on drug coverage by these plans may alter significantly the equilibrium nature of the market.

It is our purpose in this section to sketch the important features of an economic model of this industry, in particular to identify the critical decision margins for the agents who operate in this marketplace. Ultimately, one objective is to indicate fruitful margins for informational policy on drugs. The technical features of this model appear in two appendices to this report.

It is sufficient to focus on an individual patient with a particular illness subject to accurate diagnosis by a physician. This patient is assumed to have some medical insurance covering a portion of the cost of both the physician and the drug package. In other words, the medical insurance plan involves an element of co-insurance. Patients pay a premium which reflects among other things the riskiness of the insurance product for the underwriter.

Thus we assume a profit-maximizing (or possibly a welfare-maximizing) underwriter of insurance. Individual patients, however, are price takers so they see no relation between their individual actions and the discounted stream of premiums that they face in the future. As diagnosis of the illness

is certain, the patient faces a known medical package-diagnosis plus treatment. This feature of our analysis by eliminating the patient uncertainty that arises from disagreements by physicians on the diagnosis of the illness and the treatment only biases our case against any informational policy.

Patients have extreme limitations on their knowledge of the efficiency of alternative drug programmes; they rely exclusively on the advice of the physician. In turn, physicians while disciplined by the costs of potential malpractice suits for inappropriate drug prescriptions are motivated principally by the opportunity cost of their time in prescribing treatment. Malpractice suits flow typically from treatments that have direct negative effects for patients; treatments that leave patients no worse off than no treatment rarely generate such suits. The point is that the discipline from anticipated malpractice suits is likely to be small simply because such suits are rare and only for extreme cases.

Patients, then, in seeking diagnosis and drug treatment buy a tied package. Their knowledge on alternatives is extremely limited. Based on the expectation of illness, potential patients have an incentive to purchase medical insurance and the condition that they rationally seek to co-insure themselves is not at all stringent. Co-insurance means that they directly bear some of the cost of the medical treatment package. It further means that dispite their limited knowledge on the alternative drug packages, patients have some incentive to search across alternative physician-treatment bundles. Ceteris paribus, the larger the degree of co-insurance and the lower (higher) their search costs (productivity), the more elastic is any individual patient to any diagnostic-treatment package. In general, the demand curve facing any typical physician may be decribed as:

number of (standardized) patient visits is inversely related to the degree of co-insurance times the sum of the physician's cost plus the cost of the drug package.

The cost of the drug package is inversely related to the assiduousness of the physician's search across the alternatives and directly related to the list prices of the drugs available in the relevant therapeutic class. We assume for purposes of illustration that there are two extreme types of patients: a limited number of knowledgeable patients (quasi-experts) who are extremely price sensitive because they have low search costs or high search productivity and the majority of consumers who have extremely limited knowledge and therefore are extremely price insensitive.

Physicians are limited in number because of the significant (sunk) investment costs to enter this industry. Each physician under our assumptions enters one of two market segments. Physicians service either the (small) relatively price sensitive segment of the market or the (large) relatively price insensitive segment of the market. Physicians spend their own time searching across the alternative treatment packages for illnesses. In particular, we examine two decision margins for physicians, their price setting decisions and their search time decisions.

Physicians may have limited price setting powers because of particular health plans in force. For example, government health plans may set prices. Extra billing, however, seems to be a permanent feature of the Canadian market so administered physician prices may act only as price floors. In the U.S., physicians may practice exclusively for certain private health plans (e.g., Kaiser) which restricts their price setting powers but, as the decision to work for the private plan is voluntary, the individual physician still makes a profit-maximizing choice.

In the world of co-insurance, the mark-up of prices above marginal costs by physicians reflects the price insensitivity of the consumer in general and the degree of co-insurance in particular. More importantly for the purposes of informational policy, the physician searches until the marginal value of search in increasing revenues (marginal revenue product of search) equals the opportunity cost of the search time. This search by physicians may be low for two reasons. First, the opportunity cost of search is either the foregone revenue from another patient or the foregone value of leisure for the physician. Either of these measures is likely to be high. Second, the marginal value of search on the physician's revenue is likely to be extremely small, especially for relatively price insensitive consumers. Consumers are relatively price insensitive because of insurance and lack of knowledge.

We are now in a position to make our first policy statement. Are the profit-maximizing motives for physicians sufficient to encourage them to search optimally for their patients? Welfare here is measured on the sum of consumer and producer surpluses. Insurance considerations enter only through the degree of co-insurance by patients and their consequent price sensitivity. The answer to this question is no.

Physicians allocate their time in response to its impact on their revenues. As a result, they focus on marginal consumers: at the margin, what are the additional revenues generated by more search? Information however has a public good feature: The consumption of information on low-priced drug substitutes by one patient in no way reduces its value to a subsequent patient. Physicians, however, cannot direct their informational efforts to only the marginal consumers for they cannot identify these consumers. Otherwise, physicians might attempt to offer discriminating packages.

As well, physicians do not offer all-or-nothing packages of their diagnostic services to patients. Information provision causes some, perhaps minor, readjustment to these prices. Physicians who could offer all-or-nothing diagnostic and drug information packages would be efficient and capture all the gains from trade in this market. This result is an old well-known proportion in price theory.

The key to the amount of search on drug alternatives is the joint provision of the diagnostic and the search by the physician, an individual with a relatively high opportunity cost of time. This is important for understanding the role of advertising by the branded firms directed towards physicians. The observation that other alternative institutional arrangements do not exist to service this market suggests that either alternative arrangements are not worthwhile or there are special features to information provision which must be considered.

That the key to retail drug pricing is an understanding of the role of the physician in searching across drug substitutes for patients is reinforced if we consider differences between the individual patient (retail) market and the institutional or hospital market. Drug prices are considerably lower for group than for individual demand. We may attribute this to two possible effects. First, if information has this public good component, then a large scale of drug demand such as a hospital should generate sizable marginal benefits which warrant careful scrutiny and search over the drug alternatives. More search means lower retail prices. Second, branded drug firms may give special discounts for single source drugs to hospitals because the use of a drug at a major hospital may be an important signal of quality and medical acceptance to the rest of the market. Furthermore, drugs used successfully by patients at the beginning of any treatment phase are likely to be continued

through the treatment. For these reasons, cheaper prices of branded drugs at major hospitals correspond to introductory offers.

We now focus our attention on the retail and wholesale supply of pharmaceuticals where the economic actors are the retail pharmacies and the generic and branded manufacturers themselves. It is sufficient at this juncture to portray consumers of medical packages (diagnosis plus treatment) as uniformly price inelastic ("high" search cost) or completely price elastic ("quasi-experts" because of low search costs). Physicians then enter and service one of these market segments. Rates of return on a physician's investment in human capital are identical between these two sectors. Physicians whose patients are price elastic prescribe generic low-cost drugs when these options are available; this means that such physicians scrutinize more carefully the substitute drug packages; such physicians may operate from a clinic where physicians share the cost of drug search. Physicians whose patients are price inelastic tend to prescribe the more expensive branded drugs; these physicians search less intensively across the drug substitutes and are the object of the advertising efforts, especially the "detail men", of the branded drug manufacturers; such physicians tend to operate individual practices.

Not all price inelastic consumers buy their medical package from the higher priced, lower search physicians. Some price inelastic consumers fortuitously encounter the lower-price, higher-search physicians even though these consumers engage in limited search. In this setting, the price elastic consumers convey an external benefit on the price inelastic consumers. As a result, three classes of patients enter the retail market for prescription drugs:

(i) price elastic consumers who hold prescriptions for generic products where available, (ii) price inelastic consumers who hold prescriptions permitting or requiring generic products, (iii) price inelastic consumers demanding exclusively the branded products.

Retail pharmacies are assumed to be price takers in the market for generic products but to have local price setting powers in the market for branded markets. These assumptions are reasonable in light of the search costs held by the consumers in these respective parts of the market. For each prescription filled, retail pharmacies face a dispensing cost common to both the branded and the generic product as well as modest fixed (sunk) set-up costs. These set-up costs simply mean that every corner will not have a retail pharmacy; further, the growth in recent times of the real value of these costs coupled with perfectly elastic supplies of pharmacists is sufficient to generate the emergence and dominance of chains of retail pharmacies.

In equilibrium, under these conditions, we assert that the retail mark-up on branded drugs should exceed the retail mark-up on generic drugs. This differential provides a private incentive for retail pharmacies to recapture for the branded market inelastic consumers who were sufficiently fortuitous to obtain generic substitute prescriptions. This means that, where possible, retail pharmacies will substitute branded for generic prescriptions or will fail to substitute the generic for the branded product where the option is available from the prescribing physician. Furthermore, such actions are consistent with only a normal rate of return to both retail pharmacists themselves and the shareholders, if different, of the retail chains. Put differently, failure to substitute branded for generic products in the face

of price inelastic consumers would generate insufficient revenues to remain in business at least beyond the short run.

Several empirical predictions on equilibrium price differentials emerge from this model of the retail sector. Patients who fill their prescriptions at the medical center in the same location as the prescribing physician are likely to be price inelastic. Patients who have non-repeat prescriptions and wealthier consumers are likely as well to be price inelastic. As a consequence, retail pharmacies (i) in medical centers (ii) servicing one-shot, non-repeat prescriptions (iii) in wealthier neighbourhoods should, ceteris paribus, (i) charge a higher average price and (ii) substitute branded for generic drugs.

There are two possible policy responses: the less interventionist policy would neutralize the incentive for retail pharmacies to substitute branded for generic products, the more interventionist policy would regulate in favor of generic substitution through formularies and other "content" rules. We discuss briefly each of these options.

The less interventionist policy would be a two-part retail tariff, the wholesale price of the drug plus a dispensing fee. This obviously reduces any profit incentive of the retail pharmacist to substitute across drug treatments within any therapeutic class. There is, however, no positive incentive for the retail pharmacy to substitute in favour of generic over branded products where possible. As well, to the extent that this policy reduces quasi-rents flowing to retail pharmacies, it reduces the density of these outlets in the long run. This reduction may have negative consequences for high search cost consumers by driving up even further the costs of search.

A more interventionist policy is the enforcement of public formularies or the centralized public prescription of drugs where the public sector chooses the product for each therapeutic class. There are difficulties with these solutions. First, there are resource costs associated with the implementation of these plans either of monitoring the retail pharmacies or comparing and selecting amongst the substitute products. Second, there are no real changes in the economic incentives facing the agents. The wealth of the public agents choosing the drugs or monitoring the pharmacies in no way depends on the efficiency with which they perform these tasks. Put in a stronger fashion, if these public agents are now the key to the collection of rents by the drug manufacturers, then these agents are the potential recipients of these rents in the form of bribes to push the products of a particular manufacturer. Such schemes have been tried in Canada, in Saskatchewan in particular, and the critical economic issue is the extent of the reduction in drug prices in this province even gross of the resource cost of the public monitoring or selection agency.

We now focus our attention on the final backward link of this supply chain, the manufacturers themselves. From our assumption of a price elastic segment of consumers demanding generic products comes a competitive equilibrium for generic manufacturers with a corresponding wholesale price equal to marginal costs. Any alleged supernormal profits for first-mover generic firms in Canada in the early 1970's after the change in the laws governing the production of drugs is only an indication of the size of the quasi-rents formerly accruing to the branded firms.

The branded manufacturers facing ultimately a segment of the retail market characterized by inelastic consumers has some price-setting powers; further, those firms recognizing not only the important link between diagnosis and treatment prescription by the physician but the high opportunity cost of search for the physician have an incentive to supply low-cost information for the physician that enables the physician to recall the firm's product with ease.

The charge that these advertising expenditures are large is a charge that advertising productivity is high because search is extremely costly for physicians. The important and contentious issue is the relationship between advertising expenditures by these branded firms and their pricing policies. Is the relationship positive, and if so, what does it represent or is the relationship negative?

To highlight the significance of this relationship, we again pose a welfare question: Is advertising by the branded firms excessive, appropriate or insufficient? To answer this question, we formulate, as we did to evaluate physician search, a welfare index measured as the sum of consumers' and producers' surpluses. We treat advertising parametrically and evaluate the sign of the marginal social welfare of advertising at the level of advertising in the profit-maximizing interests of the branded firms. With the model of supply that we have constructed, advertising potentially alters all of the decision margins of the supply-side agents - physicians, retail pharmacies, wholesale pricing policies of the manufacturers.

Although we have no specific empirical evidence, it is our judgment that changes in the advertising policies of the manufacturers have minimal impact on the pricing policies of physicians whether they are independents or part of a clinic or part of a health plan. To the extent that advertising lowers the

costs of search for the physician, such advertising should stimulate physician search. In turn, this alone should lower the costs of drugs to the final consumers. The critical issue is what happens to the price elasticity of the price inelastic consumers. Do retail pharmacies and therefore branded manufacturers face more or less elastic demand curves?

In the model sketched in the appendix to this section, all of the effects of information or advertising accrue to consumers through price search models so that advertising as a signal of unobservable product quality plays no effect. This would appear to be reasonable for drugs as doctors would appear to be knowledgeable about the "quality" of drugs; rather, the uncertainty principally focuses on the relative costs of the alternative treatments.

If advertising principally improves the efficiency of physician's search, then such advertising is socially underprovided; if advertising principally decreases the price elastic of demand for the particular advertised drugs, then it is overprovided. While the direction of these effects is not surprising, the general non-optimality feature is surprising and warrants a comment.

The source of the non-optimality feature involves an informational externality common to "garden-variety" price setters. For the firm's private profit-maximizing interests, the important consumers are the marginal consumers whose interests combined with marginal costs determine the advertising budget. However, benefits or costs from any informational policy accrue to all of the consumers of the product and it is their interests that matter for social purposes. If advertising policy principally induces search, then its benefits accrue to all consumers; symmetrically, if advertising policy principally decreases price elasticity to raise prices, then its costs accrue to all consumers. Which of the possible advertising effects is dominant

is an empirical and not a theoretical issue. The virtue of the theoretical model is that it has pinpointed the two critical effects within the context of an equilibrium model that embraces all of the institutional features held to describe this industry.

In the next section, we list the open empirical questions that need to be assessed in formulating policy for this industry.

Appendix 1

The Consumer Demand for Pharmaceuticals With Insurance

If a patient contacts a given illness, suppose the perceived production function for treatment (t) is defined by $t = \min[1,D]$ where there is one unit of (homogeneous) physician's service and D units of a drug package where each physician accurately diagnoses and treats the illness. This technology then assumes complete diagnostic information and asserts a fixed-coefficients complementarity between the physician's diagnostic input and the appropriate drug package. Obviously, the coefficients as well as the drug package will vary across illnesses.

Define r to be the probability faced by each consumer of contacting the ill-health. Should the consumer become ill and seek treatment the price of the physician's service is q and the cost of the drug plan is $Q(T,P)$ where P is the vector of retail prices and T reflects the time of the physician in seeking the minimum-priced package of drugs suitable for the patient. Obviously $\partial Q/\partial T \equiv Q_T < 0$; T is determined as a profit-maximizing decision of the physician.

The consumer has the option of buying a health insurance plan at a premium of $R(1-k)$ which offsets $(1-k)(q+Q)$. In other words, k is the coefficient of co-insurance accepted by the patient. We denote H as the healthy state of the patient and ℓ as the loss in health because of the illness. The treatment t offsets the loss of health so that after treatment the state of the patient's health should illness occur is $H - \ell + t$. Finally each consumer j can engage in search at an opportunity cost per unit of search of c^j to minimize out-of-pocket expenses on the tied package of treatment; such search reduces the price of the tied medical expenses by

$\alpha(s)$ where s is the extent of search and $\alpha' < 0$. In this case, expected utility for the consumer j may be written as:

$$\Phi^j \equiv (1-r)U^0(y-R(1-k),H)+rU^1(y-R(1-k)-k\alpha(s)(q+Q(T,P))-c^j \cdot s,H-\ell+t) \quad .$$

Each consumer j then seeks to:

$$\underset{k,s}{\text{Max}}\ \Phi^j$$

The first-order conditions for each consumer are:

$$k: \quad (1-r)RU_1^0+rU_1^1(R-\alpha(s)(q+Q(T,P))) = 0 \qquad (1)$$

$$s: \quad rU_1^1(-k\alpha'(q+Q(T,P))-c^j) = 0 \qquad (2)$$

If we define $m \equiv (1-r)U_1^0/rU_1^1$, then (1) may be rewritten as

$$(m+1) = \alpha(s)(q+Q(T,P))/R \qquad (1')$$

If m is sufficiently large (small), then conditional on s and a given set of prices, $k=1(0)$ (or k is such that there is complete (no) co-insurance). Otherwise $0 < k < 1$. The degree of co-insurance plays a crucial role in determining the price elasticity of drugs; as well, any public information program could potentially alter $\alpha(s)$, the efficiency of private search.

(2) may be interpreted as:

$$-k\alpha'(q+Q(T,P)) = c^j \qquad (2')$$

or at the margin the marginal cost of search equals the expected marginal reduction in the price of the tied package provided $k > 0$.

Conditional on the distribution of c^j, each physician faces a demand curve for patients given by (2). All consumers have identical tastes; demand is driven by the distribution of search costs. We may write this demand for the typical consumer j (suppressing r) as:

$$n^j = n^j(k(q+Q(T,P))).$$

We now consider the profit function formed by the "typical" physician serving a group of homogeneous consumers. Each physician takes k, the degree of co-insurance, as a given. Each patient consumes a standardized unit of the physician's time. The physician's opportunity cost per patient for a "standard" visit is c; this measures the opportunity cost of time for the physician. Each physician has F sunk investment costs in training. Search, once the costs are incurred, benefits each consumer in the class. In this class, the typical physician's profit function is defined as:

$$\pi^P \equiv n[k(q+Q(T,P))]\cdot[q-c]-CT-F$$

The insurance process remains unspecified but each physician receives, either directly from the patient or indirectly through the insurer, the fee of q per patient. Physicians have price-setting powers in this scenario for the consumers that they face. Each physician $\max_{q,T} \pi^P$. Respective first-order conditions are defined as:

$$n'k(q-c)+n = 0 \qquad (3)$$

$$n'kQ_T(q-c)-c = 0 \qquad (4)$$

Conditions (3) and (4) yield the private equilibrium for q^* and T^*. In turn, q^* and T^* conditional on k yield for each physician in this

private equilibrium, a number of patients $n(k(q+Q(T^*,P)))$. (4) tells us that physicians allocate scarce time resources to minimize the drug cost component of the treatment package until the marginal revenue product of their time per standardized patient diagnostic $(n'kQ_T(q-c))$ equals their opportunity cost (c) . Together (3) and (4) reveal that $-Q_T = c/n$; if we hold q constant, more consumer search search leads to more elastic consumer demands which, in turn, yield greater physician search for lower-priced drugs. The market for physicians is in equilibrium when $\pi = 0$; more physicians alter the consumer search process (unspecified here) to yield equal quasi-rents for the physicians whether they service low or high search cost segments of the market for treatment of illness.

If the optimal coinsurance were $k=0$, then the physician would set $T=0$ provided $c > 0$. In other words, it is the insurance scheme <u>not</u> the agency relationship that is at the heart of the price inelasticity of the drug component of the treatment package.

A welfare measure for resource allocation in this market alone is given by the sum of consumers' and physician's surpluses less resource costs, holding constant the retail prices of drugs. As diagnostic services and drug treatment are a tied package, we may treat the bundle as a single good with the price index $q+Q(T,P)$. Here we have examined the incentives for information search by a "typical" physician so only that physician's surplus enters our calculations. The market at large requires an appropriate adding up of surpluses; this does not alter our results. This welfare evaluation is second best as we assume that q^* is fixed (either

by the physician, the insurance firm or government regulation). As well, retail drug prices are taken as givens at this juncture. Welfare may then be written using surplus measures as:

$$W \equiv \int_{q^*+Q(T^*,P)}^{\infty} n(k \cdot s)ds + N^P \cdot \pi^P$$

where N^P is the equilibrium ($\pi^P=0$) number of physicians. The corresponding marginal welfare expression is given by

$$\frac{dw}{dT}\Big|_{T^*} = -n(k \cdot (q^*+Q(T^*,P)))(\frac{\partial q}{\partial T} + \frac{\partial Q}{\partial T}) \qquad (5)$$

The physician's allocation of time is non-optimal for the conventional reasons that price-setting agents yield prices that are too high. Here, the result is slightly indirect. If we take the rules governing the setting of the physician's fee as given, then physicians search to equate their marginal private <u>revenue</u> product to their opportunity cost of search rather than the marginal <u>social value</u> of search equal to their opportunity cost. (5) reveals that if prices and drug costs are competitively determined by markets so that individual firm demand curves are price elastic, the deviation between private and social incentives disappear. Of course, accomplishing this objective may <u>not</u> be worth the transactions costs of doing so.

Although we have not modelled explicitly here the medical market equilibrium, we expect that changes in physicians' search for all patients would increase consumer price elasticity causing q to fall. In this case, physician's search is too low because of not only unappropriated social margins on drug costs but on physician's fees as well.

Appendix 2

The Retail and Wholesale Supply of Pharmaceuticals

In Appendix 1, we generated a simple partial equilibrium model of the consumer demand for pharmaceuticals as part of the tied package (together with the diagnostic services of physicians) of medical treatment. In this model, physicians prescribed drug treatments according to their knowledge of drug alternatuves within a particular therapeutic subclass. Consumers search with varying intensity across physicians according to each consumer's search costs (or equivalently search productivity) and the pay-off to the consumer from search. The smaller are the user costs of the medical package borne by the consumer (the larger is the insurance coverage), the smaller is each consumer's incentive to search for a lower-priced medical package. The more price inelastic are individual consumers, the lower in turn are the physician's incentives to search for cheaper but identical drug components of the medical package. We now focus our attention on the economic forces at work in the retail market for pharmaceuticals.

(1) The Retail Market

Without modelling explicitly the search process of consumers, we can understand the motives facing retail pharmacists by dividing consumers into two categories: (1) n^e who are price elastic and (2) n^i who are price inelastic. (n^e+n^i constitute the total population.) For example, if the n^e customers have sufficiently low search costs and information on medical packages is discrete (e.g., if consumers could buy a directory of alternative tied prices), then n^e customers could support a competitively priced package of medical services for each treatment. These physicians not only charge a lower (competitive) price but prescribe generic drugs. We define this

competitive package (following our previous notation) as $\hat{q}+Q(\hat{T},P^g)$, where P^g is the price of generic drugs. There is a second class of physicians servicing the inelastic portion of the market charging higher prices and prescribing branded drugs. We define this package as $\tilde{q} + Q(\tilde{T},P^b)$ where P^b is the price of the branded drugs, $P^b > P^g$, $q > q$ and $\tilde{T} < \tilde{T}$.

Not all of the inelastic consumers who have high search costs and therefore search less than their elastic counterparts go to high-priced physicians. A proportion γn^i are lucky and discover a physician servicing the elastic portion of the market and prescribing generic drugs at $\hat{q} + Q(\hat{T},P^g)$; a proportion $(1-\gamma)n^i$ are, however, unlucky and discover only the high-priced physicians prescribing branded drugs at $\tilde{q} + Q(\tilde{T},P^b)$.

The demand facing retail pharmacists then consists of (i) n^e elastic consumers who wish to buy generic drugs at P^g (ii) $\gamma n^i(\hat{q}+Q(\hat{T},P^g))$ inelastic consumers who have been prescribed generic drugs (iii) $(1-\gamma)n^i(\tilde{q}+Q(\tilde{T},P^b))$ inelastic consumers who have been prescribed branded drugs.

The behavior of the retail pharmacist in servicing these groups depends critically on the profit incentives facing the pharmacist. We first analyze these incentives when pharmacists face given wholesale prices for branded and generic drugs and are allowed to set retail prices. Then, we consider a two-part pricing scheme involving common dispensing fees disclosed to the consumer plus a wholesale price, either actually paid by the pharmacist or set by an official wholesale price list.

Consider a simple therapeutic class containing one branded drug and one generic drug that are perfect substitutes. Pharmacists are price takers in the competitive generic sector but enjoy some price-setting powers in the branded

submarket. If the pharmacist could sort perfectly those patients with generic prescriptions into their respective components, the profits of a single retail pharmacy would be given by:

$$\pi^R \equiv D\cdot[n^e\cdot(P^g-P_w^g)+n^i(k(\tilde{q}+Q(\tilde{T},P^b)))\cdot(P^b-P_w^b)]-C(n^e+n^i(k(\tilde{q}+Q(\tilde{T},P^b)))) \quad (7)$$

where (as before) D is the standardized drug package appropriate for the illness, P_w^i $(i=g,b)$ is the respective wholesale price of the generic and branded drug and $C(\cdot)$ captures all other costs including common dispensing costs for the pharmacy. As elastic consumers here are perfectly price elastic because of their exhaustive search, P^g is given competitively by the interaction of demand and supply at the level of the market. Then the individual pharmacy's problem may be defined as:

$$\max_{n^e,P^b} \pi^R \quad \text{which yields}$$

$$D\cdot(P^g-P_w^g) = C' \quad (8)$$

$$D\cdot[n^i(\cdot)+(P^b-P_w^b)\cdot n^{i'}\cdot k\cdot(Q_p+Q_T\cdot\partial\tilde{T}/\partial P^b] = C'\cdot n^{i'}\cdot k\cdot(Q_p+Q_T\cdot\partial\tilde{T}/\partial P^b) \quad (9)$$

and with open entry into the retail pharmacy market: $\pi = 0$. Given that there are some fixed set-up costs for pharmacies (included in $C(\cdot)$), there are a finite number of retail pharmacies, each with some price-setting power for branded drugs.

(8) gives a competitive condition that generic drugs are priced so that the retail mark-up equals the marginal dispensing costs (possibly a constant). Price setting for branded products in (9) reflects the local price setting powers of retail pharmacists for these products. Marginal retail price

increases have a two-fold impact on consumers: in the usual fashion, a higher retail price directly reduces customers; to the extent that higher retail prices by local retail pharmacies stimulate additional search by physicians, these pharmacies may experience an additional reduction in demand.

(P_w^g, P_w^b) are set by respective manufacturers under different conditions. Branded manufacturers incur substantial R&D costs to develop the drug; therefore, the fixed set-up costs to enter this market are substantial. Open-entry limits price-setting powers but the R&D costs need to be recovered. Generic firms pay a royalty to the branded firms (typically a percentage of gross revenues). While this serves to raise generic wholesale prices, it seems likely for reasons of both entry and relative price elasticities of demand that $P_w^g < P_w^b$. As each retail pharmacy is here portrayed as having local price setting powers for its branded products, the branded product is marked-up twice over marginal cost.

Given our assumptions on the nature of competition, we expect in equilibrium $(P^g - P_w^g) < (P^b - P_w^b)$ so that each pharmacy has an incentive to reallocate inelastic consumers with generic prescriptions to the branded category. The critical issues are (i) the ability of the pharmacist to identify these consumers and (ii) the incentives accorded the pharmacist to reallocate these consumers. Several consumer identification devices are present although none is perfect. In general, patients who purchase their drugs at the retail pharmacy located in the same building as the medical center where the prescribing physician is located are more likely to be price inelastic consumers and therefore candidates for branded substitution. Patients who have non-repeat prescriptions are more likely to be price inelastic consumers. Wealthy consumers are more likely to be price inelastic consumers. This leaves several obvious predictions:

pharmacies (i) in medical centers, (ii) servicing one-shot prescriptions (iii) in wealthier areas should, ceteris paribus, (i) charge higher prices and (ii) substitute branded for generic drugs.

Inspection of (7) reveals that an imposed two-part retail pricing scheme that levies a common dispensing fee ($\bar{f}$) plus a wholesale price pass-through, neutralizes the retail pharmacists incentive to substitute consumers across branded and generic products. In this case, (7) would be written as:

$$\pi^R \equiv D\cdot[n^e\cdot(\bar{f} + P_w^g - P_w^g) + n^i(\cdot)\cdot(\bar{f} + P_w^b - P_w^b)] - C(n^e + n^i(\cdot))$$

$$= D\cdot(n^e + n^i(\cdot))\cdot\bar{f} - C(n^e + n^i) \qquad (7')$$

where $n^i(\cdot) \equiv n^i(k(\tilde{q}+\tilde{Q}(\tilde{T},\bar{f}+P_w^b)))$ so that fixing $\bar{f}$ fixes $n^i(\cdot)$ for each retail pharmacy.

Three comments are in order here: (1) If the dispensing fees are not constrained to be equal between elastic and inelastic consumers, the inelastic group will face higher equilibrium fees driven precisely by the varying search costs that generate price differentials between branded and generic products; (2) To the extent that this imposed two-part tariff alters margins and quasi-rents accruing to individual pharmacies, its imposition will also alter the distribution of retail pharmacies. Lower quasi-rents eventually reduce the number of retail outlets; fewer retail outlets may reduce the efficiency of search by high search cost consumers; (3) While equal returns from fulfilling flexible prescriptions with branded or generic drugs neutralizes the pharmacist's incentives to substitute branded for generic products for price inelastic consumers, the pharmacist has no

incentive to substitute generic for branded products where flexibility permits. In fact, the existence of any rents for pharmaceutical manufacturers because of the nature of returns to product discovery through R&D means that these manufacturers have an incentive to bribe retailers not to substitute away from the branded products.

(2) The Wholesale Market

The manufacturing sector for pharmaceuticals consists of a competitive sector producing generic products paying royalties to the manufacturer of branded products and an imperfectly competitive sector producing branded products. It is straightforward to set up the profit function for typical firms in each of these factors.

Generic manufacturers servicing the retail demand for generic products face a perfectly elastic demand; they pay a proportion β of their gross revenues to the branded developer of the product. Profits for the generic manufacturer and then defined as:

$$\pi^{mg} \equiv n^{e} \cdot (P_{w}^{g}(1-\beta)-c) \qquad (8)$$

where open entry guarantees that $P_{w}^{g} = c/(1-\beta)$.

Branded manufacturers face an inelastic demand for their products derived from the collective of retail pharmacies selling their products. Advertising by the branded firms directed towards physician improves the efficiency of each physician's search so that $\tilde{T} = \tilde{T}(A)$ with $\partial\tilde{T}/\partial A > 0$. Profits for branded manufacturers, including their royalties from the generic firms, may be written as:

$$\pi^{mb} \equiv n^{i}(k(\tilde{q} + Q(\tilde{T}(A),P^{b})))\cdot(P^{b}_{w}-c)-+ \beta\cdot n^{e}\cdot P^{g} - A - G \qquad (9)$$

Both the generic and the branded manufacturers face the same (constant) marginal production costs; branded firms face significant fixed set-up costs because of the R and D investment requirement. Branded manufacturers $\max_{P^{b}_{w},A} \pi^{mb}$ which yields the following conditions:

$$n^{i'}\cdot k\cdot(Q_{T}\cdot\partial\tilde{T}/\partial P^{b}_{w} + Q_{P}\cdot\partial P^{b}/\partial P^{b}_{w}) \cdot (P^{b}_{w} - c) + n^{i}(\cdot) = 0 \qquad (10)$$

$$n^{i'}\cdot k\cdot Q_{T}\cdot\partial\tilde{T}/\partial A = 1 \qquad (11)$$

Open entry into branded manufacturing further yields $\pi^{mb} = 0$.

(10) may be solved for $P^{b}_{w} = P^{b}_{w}(A)$. (This is later useful for purposes of social evaluation.) (10) and (11) together yield (P^{b*}_{w}, A^{*}). These are standard marginal conditions that incorporate the institutional facts of this industry. (10) informs us that branded manufacturers mark-up price over the marginal production cost where the relevant elasticities for this mark-up involve the direct impact of wholesale price on list price and, in turn, on consumer demand as well as the indirect effect on each physician's search activity as an agent for their patients. To the extent that physicians are unmotivated to search assiduously for their patients because of the high opportunity cost of the physician's time, the impact of wholesale prices on search activity is small.

(11) informs us that advertising's direct pay-off is in improving the efficiency of physician search. Because of the high opportunity cost of time for physicians, branded firms provide detailed information on the

attributes of their products as a substitute for physician search. The relatively large promotional expenditures by these firms reflects the magnitude of these margins; low-priced information provided by drug manufacturers aids physicians in their search activity by reducing the marginal cost of information acquisition; in turn, this results in larger stocks of information on products held by physicians who prescribe drugs for their patients.

We now focus on a welfare evaluation of the branded firm's advertising policy. Is there too much or too little advertising by branded manufacturers? We measure welfare for this evaluation as the sum of relevant surpluses and recognize from (10) that $P_w^{b*} = P_w^b(A)$, from (9) that $P^{b*} = P^b(P_w^b(A))$, from (4) that $\tilde{Q} = Q(\tilde{T}(P_w^b(A),A), P^b(P_w^b(A)))$ and from (3) that $\tilde{q} = q(P^b(P_w^b(A)),A)$. In this case, welfare is defined as:

$$W = \int_{\underline{s}}^{\infty} n^i(ks)ds + \int_{\underline{u}}^{\infty} n^e(ku)du + \Sigma N^i \cdot \pi^i \qquad (12)$$

where $\underline{s} \equiv \tilde{q}(P^b(P_w^b(A)),A) + \tilde{Q}(\tilde{T}(P_w^b(A),A),P^b(P_w^b(A)))$,
$\underline{u} \equiv \hat{q}(P^g(P_w^g)) + \hat{Q}(\hat{T}(P^g(P_w^g)),P^g)$, and N^i $(i=P,R,g,b)$ represents the number of physicians, retail pharmacies, generic and branded drug manufacturers.

At the margin with open entry into all segments of the market, the advertising policy of the branded manufacturers may be evaluated as:

$$\frac{dW}{dA}\Big|_{A*} = -n^i(k\underline{s}) \cdot ds/\partial A \qquad (13)$$

Clearly, the privately optimal policy is not socially optimal unless $d\underline{s}/dA = 0$ which is generally not the case. The sign of $d\underline{s}/dA$ is, however uncertain and the relative effects are the contentious issues of the impact of advertising on markets in general and the pharmaceutical market in particular.

$$d\underline{s}/dA \equiv [(\partial\tilde{q}/\partial P^b + \partial\tilde{Q}/\partial P^b)\cdot\partial P^b/\partial P^b_w + \partial\tilde{Q}/\partial\tilde{T}\cdot\partial\tilde{T}/\partial P^b_w]\cdot\partial P^b_w/\partial A + \partial\tilde{q}/\partial A + \partial\tilde{Q}/\partial\tilde{T}\cdot\partial\tilde{T}/\partial A \quad (14)$$

Although we have neither a completely specified search model nor corresponding empirical results, we can discuss the issues in evaluating this expression. Changes in the wholesale prices of branded drugs and the advertising policies of branded manufacturers likely have a nominal impact on the prices set by physicians so that $\partial\tilde{q}/\partial P^b\cdot\partial P^b/\partial P^b_w$, $\partial\tilde{q}/\partial A \simeq 0$. If branded advertising improves the productivity of physician's search, then $\partial\tilde{T}/\partial A > 0$. The critical effect still outstanding is the impact of brand advertising on the cost of drugs paid by patients after the physician's search. This is the central issue in the economies of advertising. Does advertising increase or decrease prices, at least prices per unit of quality (or quality-corrected prices)? If advertising increases patient price elasticities then prices (per unit of quality) will fall as advertising increases - advertising informs physicians either of "good buys" or high embodied quality; otherwise, branded advertising by lowering the cost for physician recall of that brand may lower patient price elasticity and prices may rise.

If the cost to patients of drugs falls with advertising, then $d\underline{s}/dA < 0$ and (13) indicates that $dW/dA|A^* > 0$ so that branded firm advertising is too little. Otherwise, the sign on $d\underline{s}/dA$ is uncertain as is the marginal welfare expression in (13). If, as some contend, advertising

dramatically decreases patient price elasticities, then $dW/dA|A^* < 0$ and branded advertising is excessive. These are clearly empirical questions; equations (13) and (14) serve only to highlight the critical relationships.

The key elements in the story are (i) the existence of medical insurance and the degree of either co-insurability or the direct feedback of consumer choice on future premiums perceived by the patient (ii) the joint provision of the diagnostic and prescriptive service by the physician coupled with the high opportunity cost of search for the physician.

Why are private and (idealized) social interests, at least expressed in our marginal welfare calculations of (13), different? The answer lies with the inability of both the physician and the branded manufacturer to discriminate in informational packaging across consumers. Advertising and physician search to be efficient should be directed towards only the marginal consumer. Then the suppliers of the information could extract a price equal to that marginal consumer's evaluation of the information. Information here, however, has a public good feature in that its consumption by one individual in no way reduces its value to a second consumer. There is, therefore, an informational externality; in (13), the marginal impact of information $d\underline{s}/dA$ is captured by all consumers $(n^i(k\underline{s}))$ while in (11), the marginal impact on the revenue of the branded firm is registered on only the marginal consumer $(n^{i'} \cdot k \cdot Q_T \cdot \partial\tilde{T}/\partial A)$.

4. Open Empirical Questions

4.1 Introduction

This report sets out what we regard as the significant institutional features of this industry in a consistent theoretical structure. Many of the important and contentious issues, such as the impact of advertising by the branded firms in both retail drug prices and the search incentives of physicians, are empirical questions. While we highlight the importance of these considerations in arriving at a policy position, we do not estimate these critical magnitudes. In this section, we briefly consider the data requirements that would permit such estimation.

4.2 Issues

In principle, the ideal data set for our purposes would include for Canada advertising, promotion expenditures, prices and sales data over time by product and aggregated by therapeutic class as well as entry and exit data on manufacturers, both generic and branded. With these data, what could we compute?

First, we could identify market share stability through time and thus garner evidence on the rate of turnover of market positions. How persistent is the dominant position for various drugs relative to other industries? Data on promotion in general and sales would determine whether advertising is larger for newer products. Further, if branded advertising plays largely an informative role, we would expect that more promotional activity through detail men should occur early in the product's life cycle as informational needs by physicians are larger at this juncture.

Next, calculations of correlations on the degree of concentration within a therapeutic class at a particular point of time and subsequent entry would offer indirect evidence on whether advertising and promotion by the incumbent permit high concentration by blocking subsequent entry. Alternatively, by opening up therapeutic classes, initial advertising may facilitate subsequent entry in the manner described by Schmalensee (1983). We would also be able to calculate the effect of entry on prices. If advertising opens up markets and facilitates subsequent entry, the indirect effect of advertising on prices could be negative, ceteris paribus.

A comparison of the degree of concentration of drugs within therapeutic classes between the retail drugstore market and the institutional hospital market would permit a test across two regimes with different advertising-search components. Is the regime of retail drugstores with higher advertising, less search characterized by higher concentration?

Such data would also permit a replication of Leffler's (1981) results discussed earlier. Can we explain advertising to sales ratios for drugs across therapeutic classes by variables that record the degree of entry, the medical significance of any new drugs, whether the therapeutic classes are dominated by maintenance drugs and whether there is a high risk from unsuccessful drug therapy?

We now turn our attention to an evaluation of the policy options that flow from our analysis.

5. Policy Options

5.1 Introduction

The two margins of interest for policy on prescription drugs are (i) the choice of product indirectly by the patient through a choice of a physician and a retail pharmacy to fill the prescription and (ii) the retail price paid for the product. The final price paid for the product is made up of the manufacturer's wholesale price and the pharmacist's mark-up or dispensing fee. The choice of the product depends directly on the information set of the physician and the incentives facing the pharmacists and indirectly on the advertising policies of the manufacturing firms.

Whatever the equilibrium structure of the laissez-faire marketplace, this structure can be altered by public policies that shape pricing or informational incentives or regulate choice in a more direct and interventionist fashion. Leaving aside the political economy of regulated institutional arrangements, we emphasize that movement towards "optimal" intervention is not costless. Not only are there the direct resource costs of implementing policy, but, perhaps more importantly, there are the distortions in incentives where the income of the public agent in no way depends upon the success of the policy implementation. For example, unless the public agent choosing the least-cost alternative among substitute drug products has an incentive structure which rewards the successful choice of the least-cost alternative and punishes deviation from this ideal, where honesty is generated by repeated competition for the post, what guarantees the success of the policy? The upshot is that apparently second-best institutional arrangements may be efficient in light of transactions costs.

With these general caveats in mind, we proceed here to set out and discuss specific policy options. In particular, given the structure of our analysis, we classify these policy options as:

(a) those concerned with improving physician search across drug substitutes;

(b) those concerned with improving consumer information on the prices of prescribed drugs;

(c) those concerned with delivering new medical products into the Canadian market and possibly encouraging high-technology, R and D investment in Canada.

Public options include generally (i) the certification of equivalence of various drugs (ii) manditory price and product substitution laws (iii) further release of physicians and pharmacists from liability on incorrect product substitution (iv) private or public reimbursement schemes for drugs based on the lowest cost drug. While these options have been discussed elsewhere (Gorecki 1981: chapter 8), there are outstanding questions on these policies. We proceed to state and discuss these.

5.2 Information Policies Directed Towards Physicians

Does the market provision of information by manufacturers fail to yield an efficient allocation of resources?

Section 2 of this report identified the sense in which branded manufacturer advertising may fail to achieve an efficient allocation of resources. To pursue further this discussion, it is useful to categorize the information that must be transmitted to doctors into two types:

(i) What is the partition of drugs into equivalence classes (therapeutic classes)?

(ii) What is the function of each class?

(These types include especially information on newly introduced drugs.) Let us assume that doctors initially acquire information on the second question as part of their medical training and then upgrade this general information as required. (One potential source of information on the function of a new class of drugs may be the information provided by the first manufacturer to produce in the class.)

In the provision of the first kind of information, the free market pursuit of information is at a potential disadvantage compared to a public monopolized information bureau in a number of ways. In the free market, the transmission of information from manufacturers to doctors involves some expense to doctors. This expense is in the form of time spent both directly with detail men and subsequently in assimilating the information provided by them and further time spent studying medical journals and possibly consulting with colleagues. This expense in the assimilation of information must be undertaken by every doctor; thus the free market provision of information involves duplication of the expenditure on information.

Under a centralized system, some investment in information must be duplicated (as in any education) but much of it does not. A doctor would find it much easier (less costly) to determine equivalence classes by using a formulary than by trying to interpret the non-objective information provided by manufacturers. A doctor could determine the equivalence classes with accuracy and comprehensiveness equal to those of the formulary only by finding his or her own tests (or contributing to a collective test). The objective testing of drugs would need to be done only once under the centralized system.

What is the source of the market failure here? If there is a demand for objective information on all drug products, why is this information not supplied in the free market? The answer lies in the well-known public goods nature of information. The assimilation of information by one economic agent does not prevent the assimilation of the same information by another. As a consequence, a private supplier of information cannot collect from every individual the individual's demand price, because an individual could re-sell the information to others at a price lower than that charged by the supplier. The private cost of producing a piece of information may be much less than the social benefit of the information (the sum of the demand prices), but because the social benefit cannot be captured by the supplier, the information is not provided in the free market. Like the proverbial lighthouse, information is a public good that may be provided most efficiently by the public sector funded from general tax revenues.

An additional problem, distinct from the failure of the market to provide information, is that doctors may have less-than-socially-optimal incentives to invest in the purchase of information on the existence of low price substitutes, however this information is provided. This lack of incentive to search in the factor market for drugs is inherited from the lack of consumers' incentive to search in the final market for medical services; moral hazard is an additional influence. The correction of this incentive problem is, of course, the purpose of the product substitution laws of a number of the provinces. These allow the problem of disincentive in the doctor's choices to be corrected through changes in the pharmacist's incentives: The pharmacist is allowed or required to substitute the lowest priced drug in any class for the drug prescribed by the doctor. For example, the pharmacist may be reimbured for only the lowest priced drug (as in Saskatchewan).

Doctors, however, can write "no substitution" across prescriptions to prevent the pharmacist from filling the order with the lowest-priced drug. Evidence from the Saskatchewan case (Gorecki 1981:) shows that this happens frequently. Is this the result of a lack of information on product substitutes by doctors? Or is this the consequence of possible adverse, if minor, reactions by patients if, for example, the substitute products use different bases? Or does this reflect a mistrust by doctors for the information provided by the provincial formularies as compared with the brand specific information provided by the branded manufacturers? The Saskatchewan case should provide useful data: Are drug prices lower in this province than elsewhere? A necessary condition for a successful formulary policy is a yes response to this question.

Given our arguments about informational market failure, the next question that arises is the following.

What are the characteristics of the industry that make the suggested policy beneficial?

General arguments on the public good feature of information apply to many consumer goods market. We would not consider regulation that forced product substitution on agents in all such markets. What is unique about the market for prescription drugs? First, the "degree of equivalence among drug products" is categorical and, to an extent greater than in other markets, independent of individuals. There is a relatively weak value judgement in the claim that two drugs are medically equivalent. In any other market, even (the heavily advertised) non-prescription drug market, rating two headache remedies as equally effective would be imposing a judgement that might fit some individuals tastes but not others. This fundamental cost of having choices

made by government rather than individuals may be lower in the market for prescription drugs than in other markets. Second, there is probably less scope for spurious product differentiation in this market that might be a response to categorizing products, or ranking products, in other markets.

Any successful encouragement of price competition in the market for prescription drugs would leave innovating pharmaceutical manufacturers, the first entrants into new therapeutic classes, with lower rents. From this effect a number of implications have been drawn which must be assessed.

Would the reduction in rents affect the rate of development of new drugs?

The answer is apparently not much. Canada has only 2% of the world pharmaceutical market, so any loss of rents in the Canadian market will have a very small effect on the rate of R&D of the multinational drug companies. The effect would be important for a closed economy, but a small open economy does not face the same R&D incentive versus ex-post market efficiency trade-off.

Would the reduction in rents affect the amount of R&D research done in Canada by the multinational pharmaceutical manufacturers?

This is a claim made by manufacturers. In fact, the choice by a multinational company of a location for production of a perfectly mobile intermediate input such as information in a free market environment is based only on the relative costs, including taxes, of producing that input in various locations. The decision is not based on output market conditions. Put simply, the decision is to produce the product in the least-cost location and sell the product in the most profitable market or until appropriate profitability margins are equalized. Markets are scarcely free; free trade

is the exception. In this case, tariff and tax rules together with other restrictions either explicit such as "content" restrictions or implicit such as "mark-up" rules can affect location decisions. A further elaboration on general issues of this kind may be found in Mathewson and Quirin (1979).

The location of high-technology investment may be an instrument that the multinational drug firms might trade for more rent in the output market (for example, via a higher compulsory licensing fee or more protection against generics). But this would have to be contracted for in negotiations: the increase in investment in Canada would not follow automatically from more rents in the output market in the way that more R&D follows from greater patent protection in a closed economy. A more efficient means of contracting for greater high-technology investment in Canada may be through improvement in the investment conditions, for example, direct public subsidy.

Obviously, any reduction in quasi-rents from the Canadian market would reduce this country's contribution to R and D incentives for manufacturers. Whatever the impact of such a reduction, the need for such rents should not count against policies to improve the cost-efficiency of choices of drugs by demanders in the marketplace. Rents should be generated through the patent system and not by "holding-back" on improving the flow of information. For example, compulsory licensing fees might have to be raised and some protection against generics offered for the first few years of a patent, in order that rents not fall with increased product substitution.

Because of the specialized properties of information, an equilibrium in which information is provided by the public sector under the correct incentives and rents to manufacturers are protected by patents (or compulsory licensing) may yield greater surplus than an equilibrium in which information

provision is left up to the market. In this world, the price of the first entrant's product could be lower to generate the same quasi-rent flow as a return on the R and D investment. Now, with public information, the price-marginal cost margin does not have to cover the information costs. Surplus is enhanced only if the public provision of information is realized at a lower cost because of the specialized features of information than the private production. A further potential advantage is that the publicly provided information need not have any adverse effects on individual brand price elasticities. Under these conditions, patents and public information have a potential to improve the efficiency of resource allocation. This potential is critically dependent upon (i) the presence of the specialized features of information (ii) the possible adverse effects of private branded information on corresponding retail brand prices (iii) appropriate incentives for efficient public dissemination of information.

Will a reduction in rents reduce incentives for the provision of the second kind of information - information about the therapeutic uses of each equivalence class - and if so can this information be provided publicly?

One of the most valuable types of information concerns the availability and effectiveness of a new drug type. Currently, this information is provided by the branded, first-entrant drug mainly through promotion by detail men. The incentive to provide this information is given by the quasi-rents generated by the advantages of being first; the returns generated by the first-entrant's investment in a brand name cover the cost of this investment.

A reduction in the rents accruing to the first entrant (branded drugs) into therapeutic markets in Canada would likely reduce the incentive for these first entrants to provide this information, as the return to the provision of this information would decrease. Thus, we conclude that there is an important difference between the impact of policy in Canada on the private incentives to provide this information and the impact of policy on R and D incentives. With regard to incentives for R and D, as we argue above, increased rents in the Canadian markets would not lead to greatly increased innovation and new products because the Canadian share of the world pharmaceutical market is small; the reason is that the incentives for development of new products depend upon the world-wide returns from product development. A reduction in rents to the first entrants in therapeutic markets in Canada would affect adversely the incentives for the promotion of the new product in Canada, however, because the incentives for this promotion depend upon rents generated in the Canadian market, not rents generated world-wide.

The implication is that increased competition implemented through any of the policies listed at the beginning of this chapter, would likely be met with a decrease in the promotion of new products, which is arguably the most important promotion in the market. The question that arises, therefore is the following:

> Could public provision of information about the uses and effectiveness of new therapeutic treatments substitute efficiently for the private provision of such information?

While the public provision of the first type of information that we have considered, the information about the partition of drugs into therapeutic

classes, is relatively straightforward, the efficiency of public provision of information about the emergence of new treatments is less certain. Publishing the results of government tests on the effectiveness of new treatments does have an advantage over the provision of this information: It would likely be more objective, and hence more valuable per dollar of expenditure, than the information provided by manufacturers through detail men. (This assumes that the incentives of public agents providing the information are "neutral".) This advantage may be out-weighed, however, by another consideration. The transmission of information about new products through a formulary would not be as "intense" or "active" as through detail men. That is, the necessary investment in time by doctors may be greater under public provision of this information. This may imply a lower rate of diffusion of information about new therapies under the public provision of information.

In sum, we find that the most important potential efficiency cost of a reduction in rents to brand-name drugs in Canada is not a reduction in the rate of innovation of new drug products. Rather, it is a reduction in the rate of diffusion of information about new drug treatments in Canada. This is the cost that must be balanced, at the margin, with the static efficiency benefits of increased competition in the market.

5.3 Information Policies Directed Towards Consumers

Most of the literatue on performance and policy in the pharmaceutical industry focusses on competition among manufacturers in the wholesale market. But as Gorecki points out, the mark-up by pharmacists at the retail level is about 100%, so that half the final retail price paid by consumers is accounted for by dispensing fees. The focus on the lack of competition in the industry is at the wholesale level because the dispersion in prices

of equivalent brands is clear evidence of the imperfections, evidence that is easily accessible to investigators and "public pressure" groups like U.S. Senate subcommittees. Nevertheless, the economic potential of improving industry performance through policy directed at the retail market may be equally strong. (We say economic potential because the political feasibility of the policies we suggest may be low; the consideration of this political feasibility is outside the scope of this study.)

Evidence of potential for improved competition does not come in the form of price disperion (although this may be high); simply the observation (undocumented) that price search among consumers is low means that prices may be much higher than they would be with improved information. The fact that the market for retail pharmacies has virtually open entry so that excess profits are not earned by drugstores does not mean that prices could be lowered through improved search. In a monopolistically competitive industry, entry will dissipate rents. The price-marginal cost margin in a monopolistically competitive industry may vary from zero to the monopolist level, depending for example on the intensity of consumer search. An absence of dispersion of prices in such an industry reflects only homogeneity of consumer search costs and not low search costs (Salop and Stiglitz 1977).

There are substantial sunk costs to entering the pharmacy market, in the form of investment in pharmaceutical degrees, establishment of a brand-name, etc. Quasi-rents are therefore being earned by drugstore owners. Pharmacists are a well-organized interest-group and it is obviously in their interest to oppose any attempts to improve price search in the market. Currently, in fact, pharmacists have been successful in getting legislation passed in several provinces that places restrictions on the disclosure of prices by

telephone or through advertisements. (As well, pharmacists have attempted to restrict entry into retailing through legislation restricting ownership of pharmacies to licensed pharmacists in some provinces; elastic supplies of pharmacists mean that such restrictions have not yet generated rents.) The argument made in favour of such restrictions is unique. The claim is that advertising, even price advertising, may lead to "over consumption" of prescription drugs. In addition, the usual argument made by professional bodies in service industries - that quality of service would drop with advertising - is heard here as well. Gorecki (1981: Chapter 8) cites studies that show that quality does not fall with an increase in advertising in pharmaceuticals. Restrictions on advertising are clearly a regulation benefitting an interest group at the expense of the consumer.

Some (e.g., Gorecki) do not recommend an extensive programme to disclose the prices of prescription drugs because of the difficulty of interpretation for non-expert consumers of multi-syllabic drug names and the ease of confusing one drug for another in comparing prices. The primary difficulty with a conventional type of price disclosure plan (such as those invoked in consumer loan markets and in some life insurance markets) is the multi-dimensional nature of the product, "dispensing various drugs", offered by pharmacists. A customer usually finds it convenient to select a single pharmacist; this also facilitates the pharmacist's task of monitoring the compatability of the various drugs that each consumer is taking. In choosing among various drugstores, the consumer would be faced with price disclosure information in the form of a matrix of prices of all products (or all major) products offered by all drugstores. The choice would be made at a point in time

when the consumer does not know which and how much of the various drugs he or she will purchase in the future. This is multidimensionality of the price information, combined with the multisyllabicity of drug names would make a conventional price disclosure programme of doubtful value.

There are, however, a number of alternative price disclosure plans that merit analysis. Here we consider four general types of policies that could be adopted: (1) the status quo; (2) disclosure of the list of all retail prices; (3) requirements of (a) two-part pricing at the retail level, under which a pharmacist would price each drug at cost plus a dispensing fee common to all orders (independent of both the drug dispensed and the quantity dispensed); together with (b) a disclosure of the dispensing fee charged at each store, (4) (a) two-part pricing at the retail level under which a pharmacist would price each drug at an official "list wholesale price" plus a common dispensing fee, whether or not the list price was actually paid by the pharmacist; and (b) disclosure of the dispensing fee.

The second policy is lacking in promise as discussed above, because of the difficulty of multidimensional price search. The third policy would solve the problem of the multidimensionality of price search if pharmacists were all price takers in a competitive wholesale market. Under this policy the customers would need to compare only the single dispensing fee across all drugstores (in their neighbourhoods) before purchase. Because price comparison would be relatively easy and because consumers would be more aware of how much of the money spent on drugs was going to the pharmacists, price competition would increase in the retail market.

Recent changes in the retail market mean that two-part pricing would be implemented easily. As Gorecki (1981: 6) reports, pharmacists are already compensated with a two-part pricing system by provincial reimbursement programmes. This method of pricing was implemented to remove the incentive present under a mark-up system (analyzed in Section 2) to dispense higher-priced drugs. In British Columbia, the price paid by the buyer of prescription drugs must be separated on the bill into dispensing fee and ingredient cost. This regulation comes closest to the third type of policy.

The problems with this simple two-part pricing system arise because the wholesale market for drugs is not perfectly competitive; there is some variation in the prices paid by pharmacists for drugs, especially multi-source drugs. For the consumer, on the one hand, this means that the disclosure of the single dispensing fee may not summarize perfectly a pharmacy's prices relative to competing pharmacies. The need to compare the entire vectors of retail prices might still exist to some extent. For the pharmacist, on the other hand, incentives to search in the wholesale market may be harmed. To the extent that consumers switch to using the disclosed dispensing fee rather than total retail drug prices in cost comparison, the pharmacist has little incentive to search for low prices in the wholesale markets for multiple source drugs. Any excessive price paid in the wholesale market would simply be passed on to consumers without affecting the pharmacist's relative position in cost comparisons based on dispensing fees. (Note that the pharmacist's incentive to undertake price-search in the wholesale market is reduced only to the extent that consumers actually use the single dimensional dispensing fees for cost comparison - but it is also to this extent only that competition will be enhanced in the retail market.) An additional problem

with this option is that the wholesale prices would have to be monitored. A pharmacist would have the incentive to overstate wholesale prices (obtaining indirect reductions in wholesale prices), because this would increase the retail prices without changing the pharmacist's position in dispensing fee comparisons by consumers.

The fourth option for government policy on price disclosure in this market is also a two-part pricing scheme with the disclosure of a common dispensing fee. But instead of using prices actually paid by the pharmacist for wholesale purchases of the drugs, the set of base prices is given by the list prices of the pharmaceutical manufacturers. For multiple source drugs, the base price would be the price paid by the provincial formulary for the drug - a price that could be arrived at through a tendering process.

If a pharmacist is able to buy a drug at a wholesale price below the list or base price under this fourth policy, then the pharmacist would capture the savings in the price paid. This contrasts with the third policy option, under which the druggist would be forced to lower the retail price to consumers. This means that the buyer's incentives to search in the wholesale market are preserved, in contrast to the third option. From the consumer's point of view, the dispensing fee is a perfect indicator of the prices charged by a drugstore relative to its competitors (again in contrast to the third policy option). The consumer could use the differences in dispensing fees among drugstores along with location, service, etc. in the decision of which drugstore to patronize.

In theoretical terms, the policy that we are considering simply restricts the retail prices offered by drugstores to a single dimension in the space of prices charged for the various drugs, a single dimension along which

comparison is easy for consumers. This makes clear what the potential problems might be with such a policy. The list of base prices must be set relatively frequently; otherwise, the usual problems with price controls, such as shortages of some products could arise. But since the policy would restrict (more or less) only the relative prices of drug products this problem is unlikely to be severe. At worst, there may be some small incentive for the druggist not to stock those products whose actual wholesale prices have risen between dates of distribution of lists of new wholesale prices.

Note that price disclosure at the retail level does not substitute for product substitution laws directed at choices in the wholesale market. These two kinds of policies are complementary in improving competition at both vertical sectors of the pharmaceutical industry.

5.4 Policies to encourage high technology R&D investment in Canada

As discussed above, supporting high prices for new entrants in Canada, whether by patents or withholding any policy to improve product substitution, would not automatically increase R and D investment in this country. But the national government or the Ontario or Quebec provincial governments may be considering supporting high prices in exchange for investment here (or responding to threats by the pharmaceutical manufacturers to locate elsewhere if further policies to improve competition are enacted). For example, the recent review of compulsory licensing by Consumer and Corporate Affairs (1983) suggested as one policy option, the linking of compulsory license fees with the amoung of investment by manufacturers in Canada. This is similar to the current government policy in Britain.

We submit that the improvement of cost conditions for the production of information via instruments such as direct subsidy or tax credit is a superior policy to trading-off contractually higher output prices for more investment. There are two advantages of the direct subsidy approach:

(1) As a direct policy instrument, subsidizes would be more economically efficient that the indirect means of providing rents through higher prices: the loss in consumers' surplus from higher prices is avoided with the subsidy.

(2) The accounting of the actual costs of encouraging investment would be much easier if the costs were paid directly or through taxes than through price supports. The benefits of foreign direct investment in R and D, such as informational spillovers, possible employment benefits, must be compared with the costs of specific government programmes. This is possible only with knowledge on the corresponding costs.

6. Annotations of Selected Key References

6.1 John W. Egan, Harlow N. Higinbotham and J. Fred Weston, 1982, Economics of the Pharmaceutical Industry, New York: Praeger Publishers.

This book has ten chapters. We will review briefly the content of each. The first chapter contains only introductory and background material. In the view of the authors, the high performance of the pharmaceutical industry is indicated by the succession of better products produced by the industry but in spite of this some commentators argue that the marketing efforts, prices, and profits are excessive. The current environment of the industry indicates that in general consumer expenditures on drugs are growing at a rate less than the CPI. Forty-eight states in the U.S. allow or compel pharmacists to fill prescriptions with generic products; nationally, the U.S. Federal Government is trying to increase the set of drugs subject to maximum medicare prices.

The major drug invention prior to 1940 was penicillin. Antibiotics were developed in the period from 1940 to 1960. Prior to 1940, pharmacists mixed drugs but their role has been now relegated largely to repackaging products and providing labels.

In general, production expenses for the U.S. Pharmaceutical Industry are approximately one half of the final retail price. Material costs amount to only 10% of the final retail price. Aside from significant fixed costs, the industry on the production side has generally constant returns to scale. Marketing and promotional expenses are about 45% of gross revenues. Contrary to other products, the selection of drugs has an explicit agency relationship; doctors choose drugs; the final consumer does not. Of these marketing expenses the largest is by far field representatives, called "detail men" in the industry, who call on doctors, pharmacists and hospitals. In 1980 dollars, the cost of

these field representatives to the firms amounted to two thousand dollars per physician.

Real increases in medical costs lead to an examination of the source. Some argued that drug prices were high and that these prices were marked-up to reflect certain monopoly elements in the sale of the goods. Others argued that marketing and research and development expenditures were too high. This lead to a set of proposals to change the patent life, to substitute increasingly generics for branded products, and to require compulsory licensing of the branded products to generic firms for production. The facts are that new drug innovations were slowed in the 1970's but that the source of this slowdown was uncertain. Were the scientific opportunities simply depleted or was government regulation generally responsible for less innovation? The authors then proceed to examine alternative economic models of the industry.

The consensus is that the model that best seems to fit the industry is one of monopolistic competition with product innovation. New products are discovered continually and new substitutes to existing products are continuously developed. The static "snapshot" of the industry at any time would show Chamberlinian monopolistic competition, i.e., a positive flow of quasi-rents to a discovery and patent which would last until substitutes are developed and would just compensate, with adjustment for risk, the investment in research. Injected into a model of static equilibrium at any point is the problem of information transmission: The product quality is uncertain and difficult to demonstrate; furthermore it cannot be identified cheaply by experience. The static, buyer-information aspects are in some ways separable from the dynamic model but are linked by the high-price/marginal-cost margin giving rise to large incentives for capturing additional customers. The

industry cannot be fully captured in a simple static model. At this juncture, the authors proceed to describe the various options in terms of descriptions of static states of competition and those available to describe dynamic equilibria where multi-product firms invent and develop new products.

Specifically, they argue that the pharmaceutical industry is a dynamic one. The dynamic aspects that characterize this industry involve new products that initially appear on the market, substitutes eventually developed until the room for further improvement in small, with the dominance of the first firm lasting only a short time. The authors assert that it is necessary to make static versus dynamic efficiency trade-offs in assessing the performance of this industry. Furthermore, they argue that list price data should be viewed with suspicion since price reductions at least initially take the form of discounts. As well, they assert that dynamic price movements must be analyzed. The question is not whether the retail price exceeds the marginal cost. At any point of time, average profits may indicate quasi-rents given the risks associated with survival. Accounting profit studies are especially suspect to capitalization biases. In general, fixed costs facing the firm that are necessarily drug specific are high. This confounds private and public pricing decisions.

In the chapter on market definition and structure, the authors pursue a line of argument due to Demsetz. In this argument, Demsetz maintains that it is fallacious to argue the high concentration necessarily means excessive monopoly power. Rather, the argument is that with new products being continually developed and with potential entrants always eager to enter the market, efficiency dictates that those firms with lower costs will eventually obtain larger shares of the market. Therefore, competition is a dynamic process

with efficient firms being rewarded larger shares of the market for their efficiency but these firms are constantly challenged by new firms and new products. For example, the authors contend that in the pharmaceutical industry, high concentration is correlated with high entry.

In Chapter 4, the authors analyze the pricing behaviour of the drug industry. They argue that the common model alleged to apply to this industry is one in which firms face price inelastic consumers and that firms enjoy high entry barriers. Together these are alleged to lead to oligopolistic practices especially excessive non-price competition and sticky retail prices. In turn, consumers are "exploited" by the manufacturers of pharmaceutical products. The contention is that here again static versus dynamic efficiency is at the heart of the debate. The authors argue that the real price of drugs has fallen over the 1960's and 1970's. At this juncture, they review the literature on appropriate indices to measure pharmaceutical prices, general price flexibility issues and the degree of price competitiveness.

The next issue examined is the degree of competition between generic and branded products. Generic means either one kind of a drug or a non-branded drug. Six U.S. states have anti-substitution laws but the physician prescribing the drug is allowed to write a generic name in place of a specific brand. There is an FTC proposal to enforce substitution unless the branded product is "medically necessary". In general, the literature has not addressed the question of the effect of this type of regulation on product innovation. However, a large number of medical studies exist on the degree of substitutability between the generic and branded products. Many reports indicate that there is substandard quality of the generic products (page 55).

Chapter 5 in this book addresses the issue of entry and entry strategies. During the Kefauver hearings, many witnesses claimed that in fact the drug industry was monopolized. On the demand side, the doctors who prescribe the drugs do not pay for them and hence there is a substantial amount of pricing inelasticity. The contention was that countries that do not permit patents on drugs in fact have more fundamental research and less "molecular manipulation". This lead to the recommendation that patents should be eliminated. On the issue of advertising and consumer rationality, the authors cite Telser et al (1975) who found that there was a positive correlation between promotional expenditures and entry into various therapeutic classes. As well the same study found that there was a negative correlation between promotional expenditures and the four-firm concentration rate. This evidence then indicates that advertising is essentially pro-competitive.

Chapter 6 in this study reviews the literature on profitability in the industry. First, the authors summarize the old literature criticizing the industry for high profit rates. Then they review the newer literature on the usual bias in accounting rates of return. These biases are especially high in this industry because of (1) high research and development expenditures (2) long development lags (3) high advertising expenses (4) risk. In addition, because of the riskiness, the largest firms at any time (a set which changes frequently), being the firms with successful draws, have a high observed profit flow. It is not difficult to see that the profit figures are not "out of line" considering all of these factors. In other words, this is what one would expect given the large number of potential entrants into any specific line of drug research.

Chapter 7 in this study deals with innovation in the industry. The prime concern is with a decrease in the rate of innovation which the authors assert flows from the 1962 amendments to the Food, Drug and Cosmetic Act as well as the depletion of research opportunities as scientific ideas were becoming fully exploited. The contention is that the number of new products developed in the mid-60's was reduced by half and at the same time there was a shift in the geographical location of research and development to Europe, for example Britain, where there were looser regulations. A 1976 study found that research and development productivity declined by six-fold in the United States from the early to late 60's but there was only a three-fold decline in Britain. The authors maintain that in terms of the introduction of new drug therapy, the industry's contribution was unusually large relative to the public sector - both government and universities - and furthermore that the industry's contribution has been increasing through time. In general, on promotional activities of the industry, the authors criticize some practices as "wasteful" but at the same time report surveys that show that doctors find the detail men working for the branded manufacturers as a source of useful information even if the doctors do not trust these promoters of brands completely. They argue that there is a sound economic reason why a central source of information could be more efficient. That reason flows from the public good characteristic of information. While a central source of information may lead to greater efficiency in its diffusion, however, the authors point out that the source need not be publicly or governmentally owned. Of course, this brings out the issue that if the public sector is to play no role, then why haven't we observed a coalition of private sector interests to capture any potential gains from trade in this direction. The answer must be that either there

are no gains or that there is a further institutional reason why the private sector cannot organize to accomplish this objective.

Chapter 8 deals with the effects of regulation. Again, the same issues are addressed: is the innovation slowdown due to disincentives because of the 1962 amendments? Some (e.g. Peltzman, 1973) have aruged that the 1962 amendments are the entire cause and that these amendments have produced a loss in welfare equal to about $400 million annually.

The final two chapters of this book really summarize and repeat early arguments.

6.2 Keith Leffler, 1981, "Persuasion or Information? The Economics of Prescription Drug Advertising", Journal of Law and Economics 24(1): 45-74.

In this paper, Leffler argues that advertising for prescription drugs is in fact heterogeneous so that the question of whether it is persuasive or informative can be answered successfully only by examining the products and the advertising message and the buyers to whom this advertising is addressed. The pharmaceutical industry is a useful case study as (1) promotional expenditures are high in this industry relative to other industries (2) there are many new products in this industry (3) informational dissemination is important with complex goods and the frequent introduction of new ones (4) promotional expenditures are contentious aspects of the behaviour of this industry. Leffler points out that there is an agency issue when doctors select drugs for patients. Aside from the introduction and conclusions of this paper there are three additional relevant sections. In the first section, Leffler reviews the history and regulation of advertising intensity in this industry. In the second section, he performs empirical tests on the role of product promotion.

In the final section, Leffler analyzes the welfare effects. In particular, he considers the relationship between product innovation, product entry, product price and promotional strategies of both established and new products. Some have argued that pharmaceutical promotion to MD's was "misleading, uninformative, and responsible for high drug prices". The Federal Drug Administration now exercises control over pharmaceutical promotion; all promotion material must pass FDA inspection. There are now specific requirements in terms of content information, summary of side effects, no conclusions by inference, anecdoctal evidence and suggestions of superiority. The FDA now requires that some advertising be rewritten and demands some corrective advertising. However, the FDA monitors only advertising content and not the magnitude of advertising expenditures.

The second section addresses the issue of why pharmaceutical advertising can increase demand. The ratio of promotional expenditures to sales in the pharmaceutical industry is about 13%. From 1961 to 1978, this ratio varied between 10.4 and 14.9. The sales used in this ratio are sales in drugstores. In general, the expenditures by pharmaceutical firms on "detail men" are about three times those of the same firms on advertising in medical journals. In general, promotion is less important for hospital sales. These are the stylized facts for this industry in the U.S.

One prevailing view is that pharmaceutical advertising "is a series of repetitive, uninformative but persuasive messages". The agency relationship played by the doctor is important in understanding the role of pharmaceutical advertising. The doctor is an agent of the consumer and as such reduces the price elasticity of the consumer beyond that would prevail for more "garden-variety" products. As a consequence, this means that there is an increased

incentive for advertising to lower the physician's cost to prescribing drugs. Such advertising could (1) substitute drug therapy for another therapy (2) reduce the likelihood of inappropriate drugs (3) adversely effect lower priced substitutes. In particular, Leffler examines two hypotheses: (1) is the variance in advertising to sales across therapeutic classes completely explained by new product introduction procmotion? How much advertising is repeat-buy advertising? The latter type of advertising has been called "persuasive, uninformative" but it does lower the cost of recall for the physician. (2) if there is variation of advertising to sales across submarkets, what accounts for it? Is it (i) driven by differences in new product promotion (higher advertising for new products), (ii) higher for riskier drugs, (iii) greater for continual use, repetitive treatment drugs? This last category is a hypothesis supported by informative advertising.

In the empirical work to examine these hypotheses, Leffler regresses advertising to sales ratios for a set of products by therapeutic class in 1978 against a set of explanatory variables. There are five explanatory variables. The first variable measures the number of new products introduced between 1975 and 1978. The next set of variables are dummy variables. Variable 2 is set equal to one when the new product represents an "important advance", and set equal to zero otherwise. Variable 3 is set equal to one when the new entrant provides improved therapy and set equal to zero otherwise. Variable 4 is set equal to one when the therapeutic categories are dominated by maintenance drug use and set equal to zero otherwise. Finally, variable 5 is set equal to one for categories with high risk from unsuccessful drug therapy and set equal to zero otherwise. The results indicate that variable 1, 2 and 3 are positive and significant; this supports the pro-competitive

informational hypothesis. Negative and significant coefficients on variables 4 and 5, however, support the anticompetitive repetitive advertising hypothesis. Leffler further found that detail expenditures on drugs are strongly directed at doctors more likely to be familiar with and to use the drug. The conclusion is that advertising has both informative and persuasive features.

In section 3 of the paper, Leffler deals with the welfare effects of advertising. In particular, he asks whether advertising is entry promoting or inhibiting. Leffler argues that first-mover advantages may be enhanced by informative advertising even if the same advertising is available to subsequent firms. The informational advantages of a first-mover firm increase the consumer's trial and use of any particular drug. The critical issue is whether increased market power flows from first-mover advertising. Leffler points out that informative advertising must benefit the consumer in spite of any barrier-to-entry effect. The critical issue here is whether advertising exacerbates the principle-agent problem facing the consumer where the doctor is the agent. To pursue this question, Leffler considers a sample of 51 products between 1968 and 1977. For any firm consider its following two competitors:
(1) the product with the maximum sales in the same therapeutic class
(2) the product with the sales closest to the new product one year after the introduction. Leffler finds (i) on average new products advertise more than the product with the maximum sales in the same therapeutic class.
(ii) new firms spend more on detail men as opposed to journal advertising
(iii) incumbents advertising does not increase with entry.

Next, Leffler runs a regression to explain the market share of drugs one year after their introduction and several years later by, among other variables, the average promotional expenditures of competitors one year before

entry. He finds a positive coefficient for this variable which is consistent with the hypothesis that advertising by competitors opens up markets for entrants. As such, this advertising assists rather than deters entry.

In general, the empirical results in this paper, according to the author, show that product promotion has "significant positive effects on the entry success of important drugs", and thus supports the hypothesis that this advertising by pharmaceutical firms is informational. In general, the welfare analysis here addresses the question of whether the amount of advertising should be restricted. Other policy options including in particular formularies and centralized provision of information to physicians are not considered.

6.3 Lester G. Telser, William Best, John W. Egan and Harlow N. Higinbotham 1975, "The Theory of Supply with Applications to the Ethical Pharmaceutical Industry", Journal of Law and Economics 8(2): 449-479.

In this paper, the authors present a positive analysis to discover which factors determine promotional expenditures in the pharmaceutical industry. The early section of the paper contains a rather long and unnecessarily complex exposition on comparative statics in standard competitive markets. The analysis relevant to pharmacies begins in Section 3. The authors have data on products classified by seventeen therapeutic categories and divided into two submarkets - products sold in drugstores and those provided to hospitals. These authors present the facts that distinguish this industry from others. First, research and development expenditures are significant. Second, there is a principle-agent problem as the physician prescribes the drugs for the consumers but the authors of this study see this institutional fact as a joint input issue. Finally, promotional expenditures are broken down into three categories. Some advertising arrives via direct mail;

other advertising appears in medical journals and finally the firms in the industry also use "detail men" to visit personally physicians to give information and advice on the use of drugs for the firm they represent. The sample consists of sales data by company for the period 1962-72. As well, the authors have data on average prices for the period broken down by hospital and drugstore markets and promotional outlays for the period. Regressions are then run where the dependent variables are respectively prices and promotional activities. In general, the results show that prices tend to fall in response to entry. Advertising is properly treated as an investment in a capital stock labelled promotional capital. The entry regressions show that entry is positively correlated with investment in this promotional capital. Therefore promotional intensity should be higher as the rate of entry. increases. The direction of causation may be blurred. These results again support the pro-competitive position on advertising in this industry.

6.4 Peter Temin, "Technology, Regulation and Market Structure in the Modern Pharmaceutical Industry", 1979, Bell Journal of Economics 10(2): 429-446.

In general, Temin explains the current structure of the pharmaceutical industry through its historical evolution. There is no real theory here that is tested. Rather the approach is a historical one so that we are presented with a plausible story. There are thirteen relevant points that emerge from Temin's story. They are listed as follows:

(1) the historical evolution of the pharmaceutical industry is characterized by an increase in the size of the firm and vertical integration but no increase in industry concentration or profitability

(2) Temin emphasizes that two aspects of drug firms grew: (i) research and development - from 4% of drug sales in 1950 to 8% in 1960
(ii) advertising - from 10% of drug sales in 1950 to 15% in 1960

(3) Temin notes that, even correcting for the capital nature of research and development expenditures and advertising, rates of return in the drug industry are larger than other industries.

(4) Prior to 1938, no prescriptions were required; neither was there research and development as the technology was largely fixed.

(5) In 1938, the Federal Food, Drug, and Cosmetic Act was passed in the U.S. Over-the-counter-labels had substantial information; prescription drugs had limited information labels and these drugs were prescribed only by the physician.

(6) These changes signify a change in the customers of drug firms from individuals or patients to doctors. It is significant that doctors do not pay for the drugs they prescribe.

(7) New drugs were patentable.

(8) The charge is that patenting plus doctor prescriptions lead to high prices.

(9) Firms had a choice with their new inventions. They could license with suitably high royalty rates or they could produce exclusively themselves and refrain from licensing. In fact, they chose the latter option.

(10) Research and development/patented firms advertised more than their generic counterparts because (i) they do not share advertising returns with other firms (i.e., there are no advertising "spill-overs" or externalities) (ii) while a cartel fixes prices it typically cannot fix non-price features of the product so that there is (excessive) non-price competition. (Somehow, the drug industry was viewed as "capital-like".)

(11) Temin claims that the return to a vertically integrated firm is high. Vertically integrated here refers to the discovery, production and sales of the pharmaceutical product.

(12) Temin claims that companies compete more in advertising and research and development (i.e., non-price features) than in price.

(13) Temin reports a dramatic increase in the flow of new drugs. Approximately 20 new products per year were being introduced in the 1940's but that number had climbed to 50 per year by the 1950's. Does patenting result in excessive research and development?

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